

RubberWorld⁹³ years

THE TECHNICAL SERVICE MAGAZINE FOR THE RUBBER INDUSTRY VOLUME 272, No. 6

**RUBBER DIVISION MEETS IN CLEVELAND
FOR GLOBAL POLYMER SUMMIT**

**Basics of short fiber reinforcement
in elastomer and thermoplastic compounds**

**Lignin-soy based flexible polyurethane
foam for automotive applications**

**Tertiary amine-free and tin-free catalysts
for lower density polyurethanes**

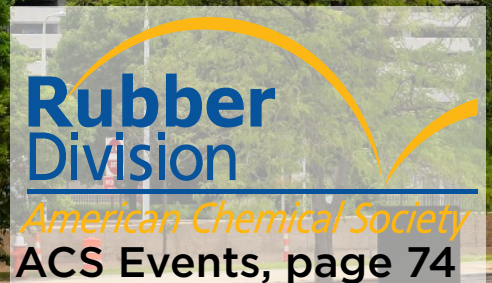
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**Rubber
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American Chemical Society
ACS Events, page 74



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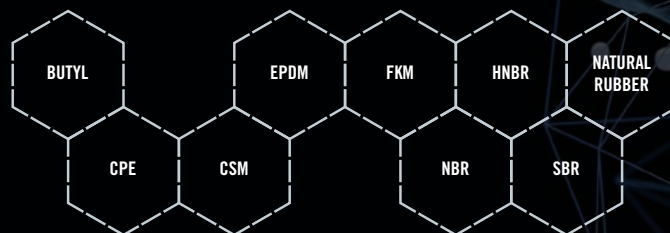
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FEATURES

51 Basics of short fiber reinforcement in elastomer and thermoplastic compounds

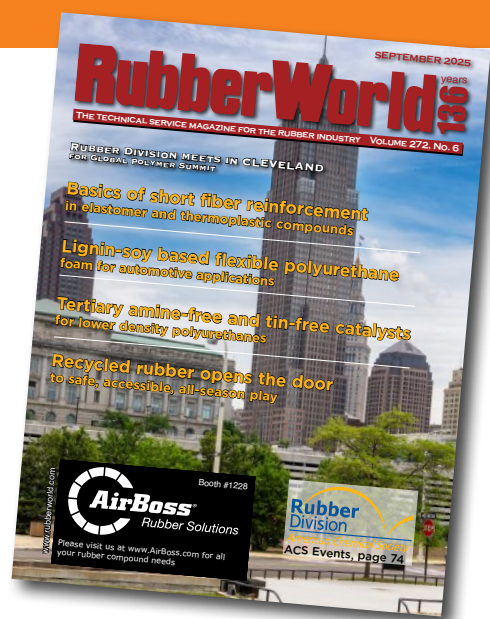
by Vishal K. Chaurasia, David Maroli and Steve Trapp, *Finite Fiber*. Short fiber reinforcement has been used in elastomeric and thermoplastic compounds to enhance properties, yet the underlying science is often misunderstood; the authors provide an overview of the science behind fibers in various compounds, comparing the individual fiber material types.

59 Lignin-soy based flexible polyurethane foam for automotive applications

by Enoch Kofi Acquah, Rafael Auras, Anibal Bher, Kevin Dunne and Mojgan Nejad, *Michigan State University*. This study focuses on partially replacing petroleum based polyol with a novel synthesized lignin based polyol and soy-polyol in the formulation of flexible polyurethane foams, with the goal being to enhance soy-polyol utilization, ultimately increasing the bio-based carbon content of the foams without compromising thermomechanical properties.

71 Tertiary amine-free and tin-free catalysts for lower density polyurethanes

by Stephen Cavender and Rajeshkumar K. Patel, *Patcham*. Ways in which various polyurethane products can be produced without using tertiary amine or tin based catalysts are demonstrated by the authors; the catalysts provide foam amines and resulting product density similar to that currently available using combinations of tertiary amines and tin-based catalysts.



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2025 PU award finalists selected

The Center for the Polyurethanes Industry (CPI) announced Algenesis Labs and Innovative Chemical Products (ICP) as finalists for the 2025 Polyurethane Innovation Award. The annual award recognizes companies and individuals who have launched innovative products, technologies or initiatives in the marketplace between June 2023 and June 2025.

“Each year, CPI is honored to present the industry’s highest technical distinction, celebrating the spirit of innovation that drives the polyurethane sector forward,” said Jason Sloan, director of CPI. “These advancements not only reflect the ingenuity of our industry, but also demonstrate how polyurethane technologies are helping to solve some of the world’s most complex challenges.”

Soleic from Algenesis Labs is a novel polyester aromatic polyurethane technology that meets the performance demands of traditional polyurethane applications, while solving the environmental challenge of microplastics. HandiFoam E84 spray foam insulation from Innovative Chemical Products is a low pressure, two-component spray polyurethane foam system engineered to maximize efficiency and reduce labor costs, while delivering seamless, uniform coverage for air sealing and energy efficiency.

Cleveland hosts GPS and Expo

This September issue of *Rubber World* arrives to you at the 2025 Global Polymer Summit (GPS), including the Rubber Division’s 208th Technical Meeting, Expo, Educational Symposium, Get Involved Session, Experience Elastomers Student Outreach Program, Awards Ceremony, and many other events taking place at the Huntington Convention Center in Cleveland, OH, September 8-11.

Be sure to pick up your copy of the *Global Polymer Summit Daily* each day. This tabloid-sized publication is filled with important news from the conference, event schedules, special features and photos from the Expo floor. *Rubber World’s Pocket Spotlight* is a handy, pocket-sized directory of all Expo exhibitors, and includes details on what the companies will be highlighting at their booths during the show.

Take advantage of this excellent opportunity to learn about the latest rubber developments and industry news, and conduct business and socialize with valued customers. Please be sure to stop by the *Rubber World* booth (#1318) to say hello. *Rubber World* wishes you much success at the GPS!



Jill Rohrer

RubberWorld

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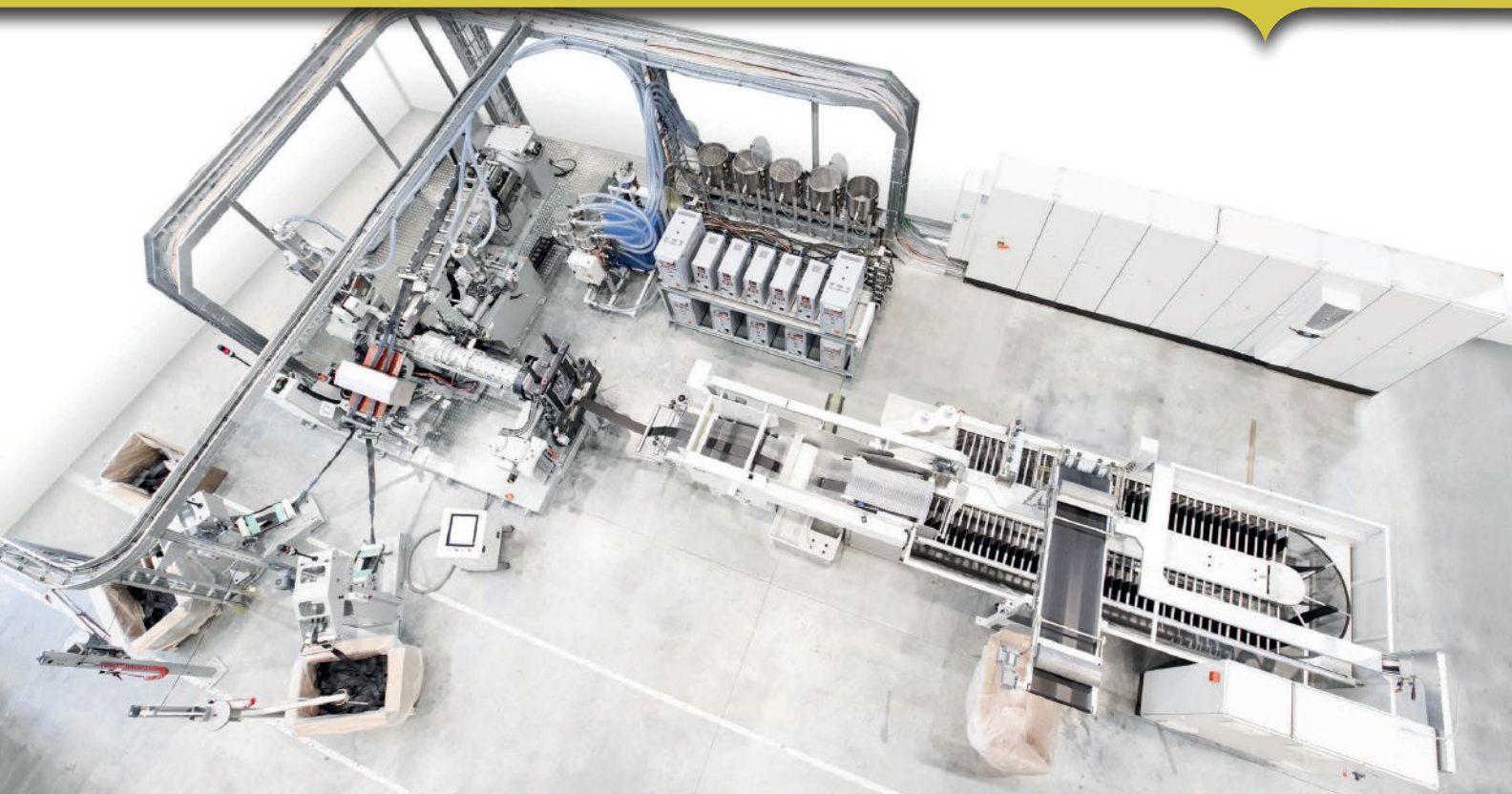
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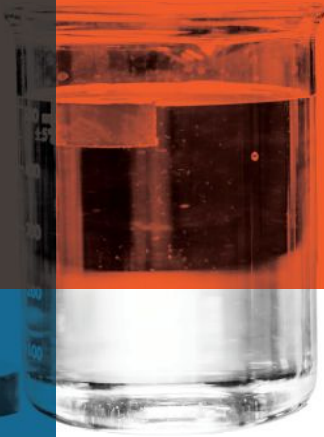


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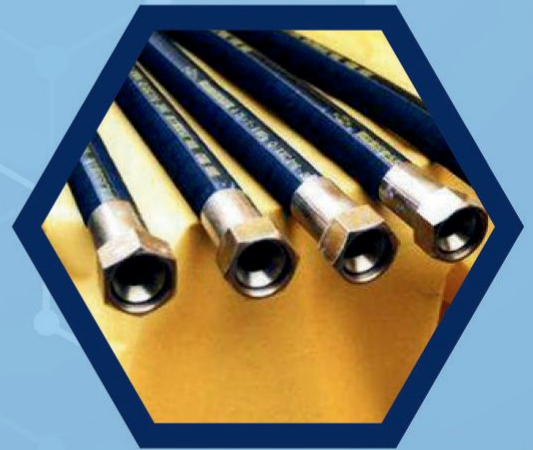
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Business Briefs

Cabot to acquire Bridgestone facility

Cabot (www.cabotcorp.com), Boston, MA, has entered into a definitive agreement to acquire **Mexico Carbon Manufacturing S.A. de C.V. (MXCB)** from **Bridgestone**.

ACQUISITIONS, EXPANSIONS

The reinforcing carbons manufacturing facility was commissioned in 2005 and is located in close proximity to Cabot's current reinforcing carbons facility in Altamira, Mexico, which has operated successfully since 1990. The acquisition is said to underscore Bridgestone's confidence in

Bolder Industries expands U.S. capacity as demand increases

Bolder Industries (www.bolderindustries.com), Boulder, CO, the circular solutions provider for the rubber, plastics and petrochemical industries, is investing in its Terre Haute, IN, facility and its Antwerp, Belgium, project in the Port of Antwerp's NextGen District. Since 2019, through its Maryville, MO, facility, Bolder has delivered commercially proven solutions across more than 3,000 applications in tires, rubber, plastics and coatings.

The Terre Haute expansion, scheduled for completion in 2026, will feature four proprietary reactors within its 66,000 square foot facility. The site will recycle 6.6 million end-of-life tires annually, producing nearly 18,000 metric tons of BolderBlack, and 21,000 metric tons of BolderOil, delivering sustainable alternatives to virgin carbon black and fossil based oils.

In Europe, Bolder is advancing its Antwerp facility through the N2TR: NextGen Thermal Tire Reuse Project, co-funded by the **European Climate, Infrastructure and Environment Executive Agency (CINEA)**. Slated for full capacity in spring 2027, the site will anchor a global supply network designed to provide consistent, high performance materials across industries.

"Too often, 'innovation' stops at the pilot stage. Our success is measured in thousands of metric tons, not truckloads, because manufacturers need dependable supply to make sustainability a real part of their business," said Tony Wibbeler, founder and CEO of Bolder Industries.

"Our customers' formulations demand consistency and performance that match or exceed virgin materials. BolderBlack meets strict performance specs, while BolderOil delivers the right chemistry," said Nate Murphy, head of technology at Bolder Industries. "We've built our process to scale without compromising on those technical parameters, so the results you get in the lab are the same results you see in production; whether that's 30 metric tons or 3,000."

Made entirely from post-consumer and post-industrial end-of-life tires and carefully curated scrap rubber, Bolder products are said to cut lifecycle greenhouse gas emissions by up to 85% compared to traditional production methods.

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Business Briefs

Cabot as a trusted partner with a proven track record of delivering high quality, reliable supply. Under the terms of the acquisition, Cabot will strengthen its longstanding partnership with Bridgestone through the long term supply of reinforcing carbon products from MXCB for Bridgestone. In addition, the facility also has the capability to manufacture other reinforcing carbon products, providing flexibility to support broader customer needs and future growth opportunities.

ACE Laboratories (www.ace-laboratories.com), Ravenna, OH, has expanded its analytical testing capabilities with the acquisition of a new **Agilent** gas chromatography/mass selective detector (GC/MSD) system to meet growing demand for regulatory compliance and quality control release testing. This additional GC-MS system is said to enhance ACE's capacity for trace level analysis of substances such as nitrosamines, siloxanes, residual solvents, polycyclic aromatic hydrocarbons (PAHs), phthalates and other controlled substances found in rubber, silicone, adhesives, coatings and polymer based materials.

G. Bareich Import-Export (GBIE) (www.gbie.com), Windsor, Ontario, Canada, a manufacturer of high performance, water based coatings for the global automotive weatherseal market, announced further expansion with a new technical sup-

port and distribution center in India. Strategically located near Delhi, and within the National Capital Region (NCR), the facility is said to further strengthen GBIE's ability to serve India's rapidly growing automotive and electric vehicle markets with local inventory and specialized technical expertise. This expansion has been established in partnership with a trusted local team, enabling faster turnaround time and closer support for manufacturers across the region, according to GBIE.

Arterex (www.arterexmedical.com), Scottsdale, AZ, a global medical device developer and contract manufacturer,

Quality registrations

LCY Chemical (www.lcycic.com), Kaohsiung, Taiwan, announced that the **Carbon Disclosure Project (CDP)**, said to be the world's leading climate rating organization, has announced its 2024 assessment results for supplier engagement, and LCY Chemical earned the highest "A" rating and was named a 2024 CDP Supplier Engagement Leader, securing its place among the world's leading companies. This distinction is said to highlight LCY's excellence in supply chain management and its strong commitment to sustainable governance.

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Business Briefs

has expanded its portfolio of medical device manufacturing companies with the acquisition of **Xponent Global**, an ISO 9001:2015 certified producer of extruded tubing for the medical industry based in Hudson, MA. With eight extrusion lines across 55,000 square feet of manufacturing space, including 5,000 square feet of Class 8 cleanroom space, Xponent Global is said to provide high quality precise filaments, over the wire extrusion, multi-lumen, taper tubing, para tubing and tight tolerance single lumen tubing for a range of applications.

Trelleborg Sealing Solutions (www.trelleborg.com), Trelleborg, Sweden, announced the significant expansion of its Innovation Center in Plymouth, MN, to take on additional projects and accelerate the design and development cycle for customers. The Innovation Center will concurrently move to a new purpose built space in nearby Delano. This project involves a remodel of the tool shop and room for expansion: 6,000 square feet/557 square meters total. It also includes nearly 40,000 square feet/3,716 square meters of new construction comprising a visitor center, additional high end Swiss machining, injection molding and increased space for the automation laboratory.

H.M. Royal celebrates 100 years of supplying CASE formulations

H.M. Royal (www.hmroyal.com), Trenton, NJ, a national distributor of specialty chemicals and raw materials, celebrates its 100th anniversary in 2025. This milestone is said to reflect a century of resilience and commitment to customers and partners.

Founded in 1925 by Horace "Kid" Royal, the company is said to have grown from a regional distributor into a nationally recognized supplier and technology resource for manufacturers of rubber, plastics, coatings, adhesives and sealants. With a robust portfolio of high performance materials and longstanding partnerships with premier manufacturers, H.M. Royal is said to continue to deliver customized solutions that meet the evolving demands of the marketplace.

"We are deeply honored to celebrate 100 years of service to our customers, partners and employees," said Joseph Royal, president of H.M. Royal. "Our centennial is not just a reflection of our longevity; it's a tribute to the people and relationships that have shaped us over the decades. From our founding through today, we've remained committed to integrity, innovation and operational excellence. We look forward to the next chapter of our journey with gratitude and renewed purpose."

Over the past century, H.M. Royal has strategically expanded distribution channels and supported critical applications, with an emphasis on technical consultation, customer support and agile supply chain solutions.



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HB Chemical was founded in 1985 and has grown to be a distributor of quality rubber chemicals and products throughout North America. With 10 warehouses located in the US, Mexico and Canada, HB Chemical provides the most economical products to meet customer needs and quality requirements while providing the very best in customer service.

In 2006 our Northeast Ohio warehouse expansion was completed to serve our distribution warehouses in California, Georgia, Illinois, Massachusetts, Missouri, North Carolina, Texas, Virginia, Ontario, Canada and several locations in Mexico.

HB Chemical is certified to ISO 9001 standards and is recognized as one of the top 30 US Chemical Distributors and among the top 80 in the world by ICIS Magazine.

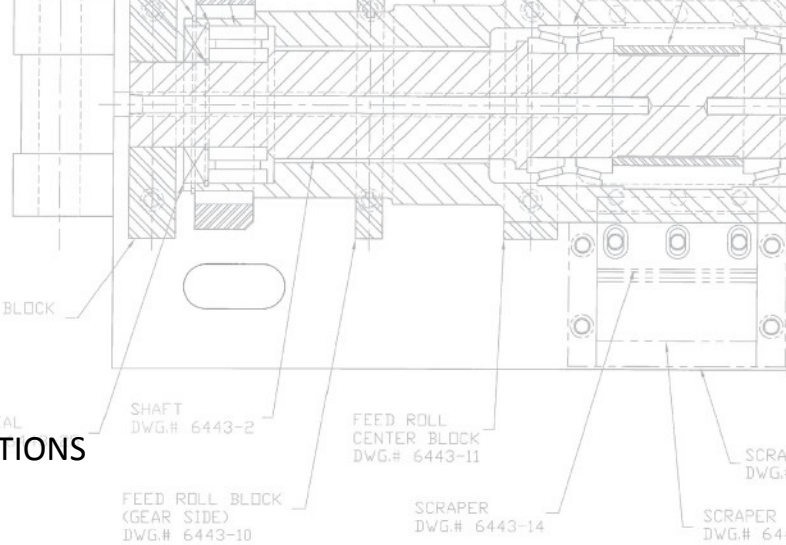
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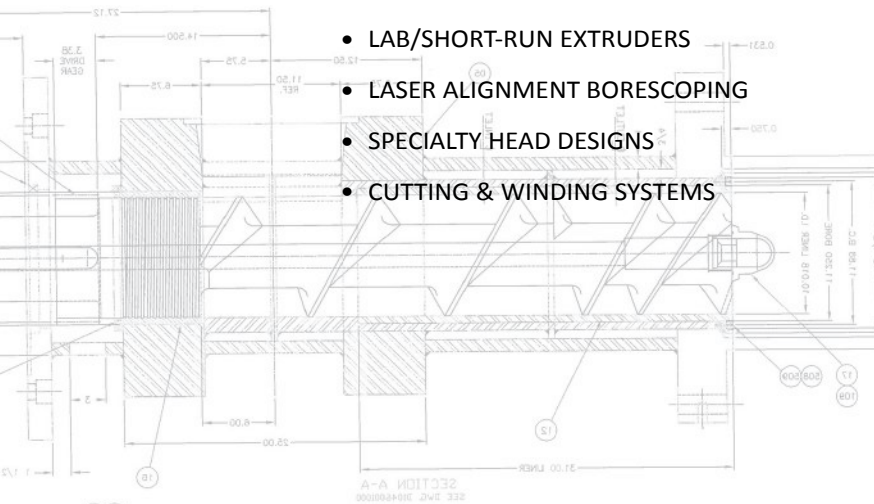


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Business Briefs

TBC expands with Giti Tire partnership

TBC (www.tbccorp.com), Palm Beach Gardens, FL, a North American marketer of automotive replacement tires through wholesale and franchise operations, is expanding its product

CONTRACTS, LICENSES

a broad range of tires designed for passenger cars, SUVs, 4x4s, commercial vans, trucks, buses, and more, to meet a wide variety of road conditions.

Bridgestone Americas (www.bridgestoneamericas.com), Nashville, TN, was named sole partner for **Lamborghini's** Fenomeno supercar.

portfolio via a strategic partnership with **Giti Tire's** operations in North America. Giti Tire serves customers in more than 130 countries and offers

Hexpol celebrates suppliers, honors commodity manager

Hexpol Compounding Americas (www.hexpol.com), Burton, OH, recently celebrated strategic supplier relationships during its annual Supplier Appreciation Day in Akron, OH. "At Hexpol, our supplier relationships are more than a procurement strategy, they are true partnerships," said President and CEO Gary Moore. "Close collaboration with our suppliers allows us to unlock cost efficiencies, elevate product quality and drive sustainable innovation that benefits our customers, our business and our environment."

Celebrating supplier relationships cannot be done without acknowledging the hard work of the HCA procurement team led by Mark Ramsey, chief procurement officer. "Our procurement team plays a pivotal role in shaping resilient, high performing value chains," said Ramsey. "By actively nurturing supplier relationships, we ensure shared goals are met and drive long term value and innovation across the business."

During the event, Karen Chickletts, retired strategic commodity manager from HCA, was honored for her hard work, commitment and contributions over her 22 years with Hexpol. In her role, Chickletts created, nurtured and grew many lasting supplier relationships. "As Karen begins her retirement, we could not think of a better send-off than a celebration with many of her supplier partners in attendance," said Moore. "We're very proud of the work Karen has contributed over the years, and wish her all the best in the next phase of her life!"



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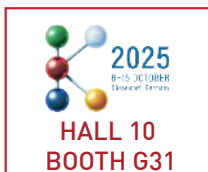
REPEATABILITY



TRACEABILITY



MONETARY SAVINGS



Business Briefs

Smithers sponsors key GPS events to celebrate

Smithers (www.smithers.com), Akron, OH, is celebrating its 100th anniversary by sponsoring both the welcome reception and the Women of Rubber Division (WORD) event at the

CORPORATE, FINANCIAL NEWS

2025 Global Polymer Summit, organized by Rubber Division, ACS. Smithers is a provider of testing,

consulting, information and compliance services for the rubber industry. In addition, Josh Guilliams, vice president of consultancy, will be speaking on the evaluation of 6PPD alternatives for the tire industry.

Shin-Etsu celebrates 40 years of silicone growth in America

Shin-Etsu Silicones of America (www.shinetsusilicones.com), Akron, OH, recently celebrated its 40th anniversary. Shin-Etsu Chemical is said to be one of the largest chemical companies in Japan, producing over 5,000 different silicone products worldwide.

Shin-Etsu Silicones of America (SESA) first entered the United States in 1982 as a trading company in a Los Angeles, CA, sales office with two employees from Japan. In 1985, Shin-Etsu Silicones of America was legally incorporated. Three years later, the operation expanded into the Torrance, CA, technical center, beginning the first domestic production of silicone in 1989. In 1990, SESA formed a joint venture with an Akron, Ohio based compounder of HCR silicones, Novacor, and the new company was named Shincor Silicones. By 1991, Shincor had become a wholly owned subsidiary of Shin-Etsu Chemical. With a large manufacturing footprint established in Ohio, SESA decided to move its entire operation to Akron in 1995 into a newly constructed plant and headquarters. Since 1995, SESA has dramatically expanded its facility and production investments in Akron with the acquisition of three more buildings and the construction of two new manufacturing plants. Altogether, SESA currently owns 45 acres of land in Akron with 220,000 square feet of building space, and employs 230 people. In 2003, an organofunctional silanes plant began production in Freeport, TX, and the company's state-of-the-art cosmetic application laboratory was established in 2011 in Totowa, NJ. The lab was later consolidated into SESA's fluids research and development center in Paramus, NJ, in 2015.

Since its inception, SESA has grown from two employees in the Los Angeles sales office to 287 employees nationwide. Over the course of 40 years, SESA's sales have increased to hundreds of millions of dollars. According to John Heitler, SESA's chief operating officer, "SESA's impressive growth is directly attributable to the company's absolute commitment to safety, quality and the continuous development of specialty products that deliver value to our customers."

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Quality spurs testing equipment market

A study from Future Market Insights (FMI) says the global rubber testing equipment market is expected to flourish due to the high demand for quality rubber products from industries such as automotive, aerospace, construction and healthcare between 2025 and 2035. Moreover, technological developments in digital testing, automation and precision analytics are optimizing the efficacy and dependability of testing processes, thereby driving the expansion of the global rubber value chain.

Physical, mechanical and chemical properties of rubber materials are determined using rubber testing equipment maintaining longevity, functionality and worldwide quality standards. With a focus on product safety and innovation, manufacturers are increasingly looking to use precise testing instruments: hardness testers, rheometers, tensile testing machines, aging ovens, etc.

In 2025, the rubber testing equipment market is projected to be valued at approximately \$15.6 billion. By 2035, the market size is expected to reach around \$21.08 billion, expanding at a steady compound annual growth rate (CAGR) of 3%, according to the report.

North America is a lucrative region for the rubber testing equipment market owing to the strict quality regulations in the region, as well as the presence of a large automotive and aerospace manufacturing base. The U.S. remains at the forefront of regional demand as proven by investments towards research and development and quality assurance in the manufacture of rubber goods, including tires, seals and industrial components.

A 3.1% CAGR is predicted for the rubber testing equipment market in the U.S.; stable growth as a result of strict quality assurance standards observed in automotive, aerospace and industrial rubber components. Rising demand for testing the durability, tensile strength and resistance to aging in tires, seals and gaskets is propelling sales of this equipment. ASTM and ISO standard compliance is an essential

driver for a continuous test in the production lines.

Europe is a more mature and uniform market. Countries such as Germany, France and Italy also highlight variables such as precision and quality control rubber characteristics. The region's focus on the use of durable and sustainable materials, especially in automotive, and building and construction industries, is driving demand for advanced rubber testing solutions. CAGR for the European Union is expected to be 3%.

The market in the United Kingdom is growing at a steady rate since the usage of rubber testing as a part of quality control has become a common practice in various manufacturing sectors, including construction materials, medical devices and transport components. CAGR through the period is expected to be 2.9%. With increasing investments in laboratory automation and digital material analysis tools, the demand for new testing machines is expected to grow in the coming years.

The Asia-Pacific region is the most attractive and fastest growing market for these products, as the rapid industrialization of emerging economies, the growth of tire manufacturing hubs in Asia and the increasing exports of rubber products are driving market growth. Government support for quality certification and industrial modernization further accelerates market growth in this region.

According to FMI, high initial investments in contemporary laboratory and in-line testing equipment, including dynamic mechanical analysis (DMA), tensile machines and rheometers, serve as major hurdles for the rubber testing equipment market. Litigation is often an ineffective weapon against such large corporations, and small and medium manufacturers are too often forced to outsource testing services because they cannot afford the expertise needed.

Furthermore, such equipment requires technically trained personnel in order to calibrate, measure and interpret the results

accurately; personnel often not easily accessible in any given rubber processing plant. In addition, without standardization of the data compared to legacy systems, the test results could not be immediately integrated into wider quality assurance (QA) and digital manufacturing systems, resulting in delayed decision making for real time issues.

The high costs associated with these materials have limited their growth, making it a lucrative space for potential developments. The market is expected to grow at a significant pace due to surging demand globally for high performance, safety compliant rubber products.

This trend prompts investment in high-throughput automated testing platforms that rely less on operators and shorten testing cycles. It is also increasing the adoption of smart, sensor based rubber testing apparatus that have capabilities to upload real time information to one centralized monitoring system. The increasing use of bio-based and recycled rubber materials demands flexible and adaptive testing solutions which can assess novel compounds under various thermal and mechanical stress conditions to boost innovation.

From 2020 to 2024, market penetration was primarily centered on basic mechanical property testing, with automotive tire testing, industrial rubber quality control and physical performance benchmarking. Integration with digital QA systems remained sparse; and equipment refreshes, if they happened, tended to be driven by the emergence of new regulations or product recall events.

From 2025 to 2035, the market will evolve toward modular, digital integrated and remote operable systems for predictive maintenance, AI based material characterization and eco-certification testing. Innovation will focus on non-destructive testing, micro-sample rheology and AI enhanced fatigue and crack growth simulations, particularly as next generation elastomers become more complex.

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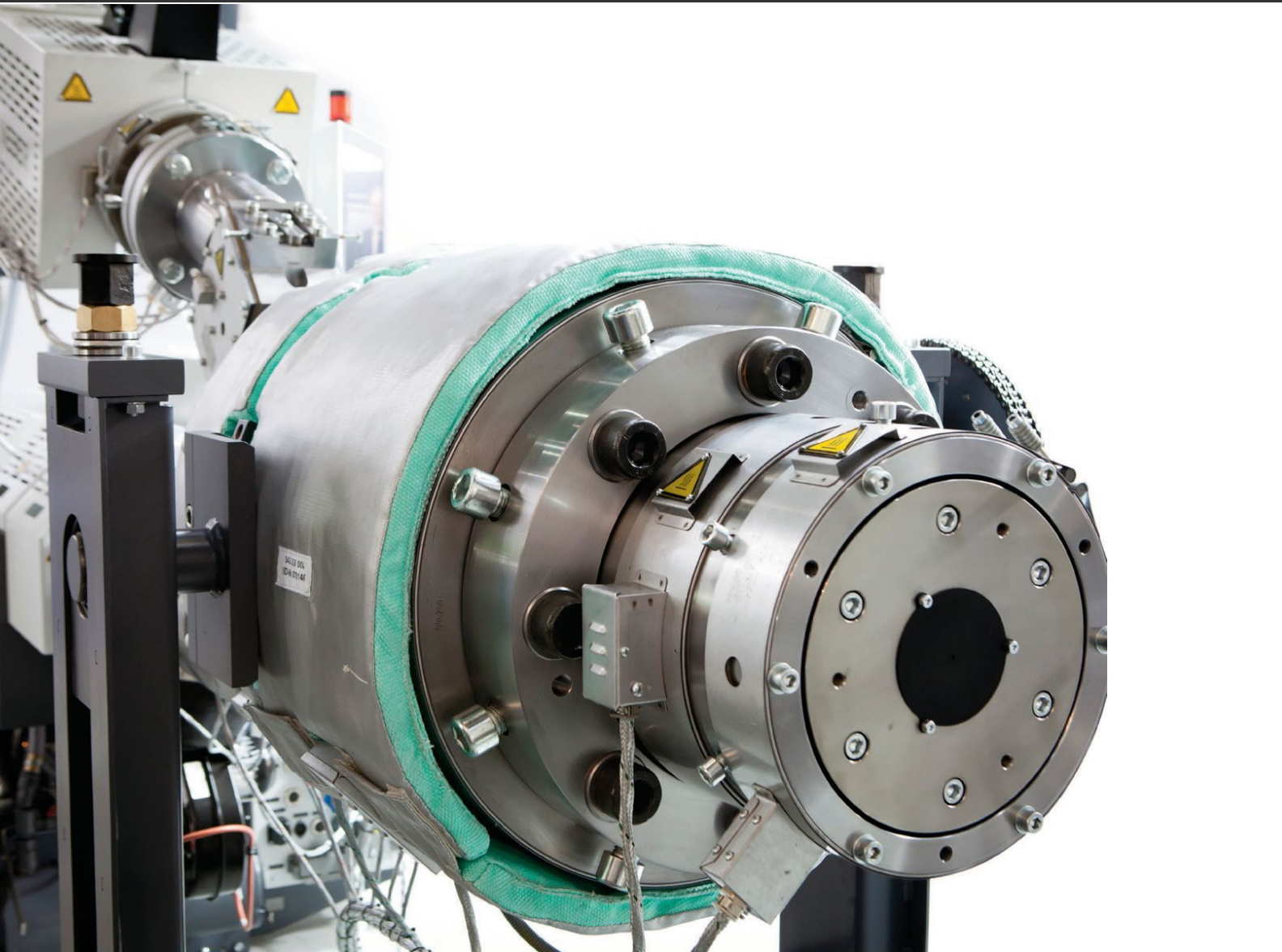
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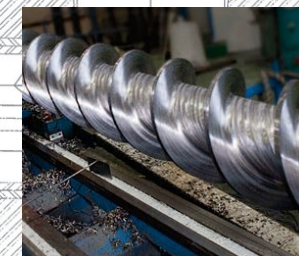
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High consistency silicone for insulators

Micro Seals are high precision micro components that are indispensable in vital devices such as anesthesia and respiratory equipment. Thanks to a close collaboration with leading manufacturers, Freudenberg Sealing Technologies meets the stringent requirements for hygiene, safety and reliability in modern medicine.

These tiny components are primarily used in fluid handling valves, pumps, mixers and small electric motors. Their dimensions do not exceed around 20 mm, but they prevent leaks and ensure that devices function reliably. Freudenberg has already developed a wide range of customized hygienic, micro sealing components. These include solutions for sealing rotating and moving parts, such as the Micro-Simmerring and a brake and sealing disc designed specifically for use in dental drills. This disc makes it possible for the dentist to stop the drill within fractions of a second; an instant stop that increases patient safety and comfort during dental treatments. Made from durable elastomers, the brake and sealing disc can withstand extreme stress at high speeds without losing its function or sealing performance. This micro component also prevents the backflow of fluids, which greatly increases hygiene during treatment. Preparing drinkable water for dental treatment units is another application of Micro Seals in dentistry. Here, an elastomer composite part, whose shape earned it the nickname “dog bone,” regulates the water supply.

Another key application is the control and regulation of fluids and gases in miniature valve and pump systems. Valve armatures control the flow of anesthetic gases in anesthesia devices, and enable precise dosing, which is critical for patient safety during surgery. Made from a combination of metal and FFKM, a valve armature ensures maximum precision and chemical resistance. This choice of material allows the component to withstand even the most aggressive anesthetic gases, which is crucial for the long term safety and performance of these devices.

Ventilators also play a key role during surgeries. Known for their high media resistance, miniature flipper valve seals are indispensable for the precise control of breathing gases. These smallest seals, made from FKM and EPDM, offer a long service life, even under extreme conditions, and can perform up to 10 million switching cycles without losing their functionality.

Micro Seals are also essential in high precision laboratory analysis devices, pipetting robots and HPLC systems. Specially developed hammer seals, rocker valves and valve seat seals are used in these applications. Rocker valves ensure precise control

of fluid dosing during automated pipetting, while the valve seat seals in HPLC devices prevent leaks and provide reliable test results.

Freudenberg Sealing Technologies manufactures its Micro Seals from highly resistant elastomers such as FKM, FFKM and EPDM. These materials offer specific advantages, depending on their application. FKM excels with strong chemical resistance and temperature stability up to 200°C, which makes it an especially good choice for environments with aggressive media. FFKM offers extremely high chemical resistance and can reliably withstand temperatures up to 230°C. EPDM, in turn, is particularly resistant to ozone, UV radiation and hot water, and is well-suited for environments with high humidity or steam.

Flash cutting for flat EMI gasket fabrication

When fabricating a flat EMI gasket, die cutting is quick and efficient at higher volumes, but there is tooling to wait for. If you need low to medium volumes instead, Specialty Silicone Products thinks you should consider flash cutting. This computer controlled cutting process uses standard knives instead of specialized tools. It is said to be great for rapid prototyping.

Flash cutting's ability to use computer-aided design (CAD) files supports new product development and multiple design iterations. It can achieve tight tolerances and produce smooth edges for a high degree of accuracy and precision. This computer controlled cutting method is not just for simple shapes. It supports design complexity and provides part-to-part consistency. Because there is no tooling to wait for, flash cutting can begin soon after an order arrives for faster turnaround times overall. Flash cutting supports parts nesting for more efficient material usage.

Water jet cutting may be a better option for thick or heat sensitive materials, but EMI sheets are not especially thick, and silicones can withstand higher temperatures than other elastomers.

Laser cutting, another tool-less process, is also an option for EMI gasket fabrication. Laser cutting is quick and efficient, but there is the potential for heat-affected zones that can cause discoloration, burning or warping. A laser's power affects how quickly it can cut, and detailed cuts typically require slower speeds. Water jet cutting will not cause heat affected zones, of course, but it is generally not as fast as flash cutting.

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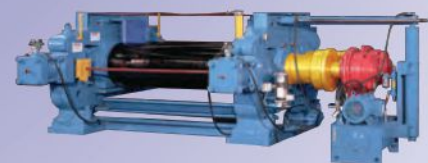
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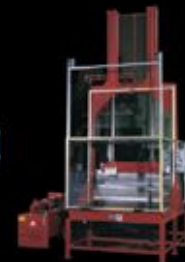
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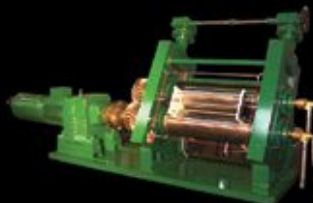
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How recycled rubber opens the door to safe, accessible all-season play

Recycled rubber is used in everything from community parks, playgrounds and playing fields to infrastructure and flooring. It is cost-effective, diverts millions of tires a year from ending up in landfills, and supports thousands of jobs nationwide. In this interview, *Rubber World* spoke with Scott Gerber, program director of The Better Play Initiative, about recycled rubber, its use in areas such as community parks and playing fields, and the science behind its safety.

Given that many people do not know about the recycled rubber process, tell us what exactly is recycled rubber?

Recycled rubber is a sustainable material processed from end-of-life tires that are transformed into new materials. During recycling, the tires are cleaned, shredded and processed, forming “crumb rubber.” The non-rubber portions of the tire, like the steel belts that give a tire its shape and structure, are also recycled. Recycled rubber is used in a wide variety of products, in-

cluding shoes, carpets, turf fields, hospital floors and playgrounds, to name a few examples.

What are the benefits of using recycled rubber surfaces?

Recycled rubber surfaces create spaces that serve people of all ages. For young children, playground surfaces with recycled rubber provide safer places to play with reduced injury risk from falls. For adults, walking paths, fitness centers and community gathering spaces with recycled rubber surfaces offer reliable places for exercise and social activities. And for older adults, the slip-resistant properties and consistent surface conditions of recycled rubber make recreational spaces more accessible and reduce fall hazards. Because these surfaces remain usable year-round with minimal closures due to weather or maintenance, they provide many people from our communities with dependable spaces for physical activity and recreation.

Recycled rubber is also one of the biggest success stories of



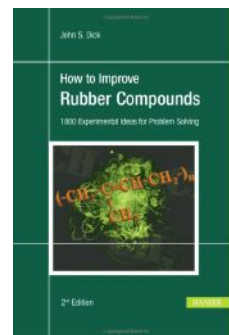
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Perspective

sustainable materials. It reduces landfill waste, decreases tires' carbon footprint by giving them a second life, and lowers park maintenance costs for many communities. The recycling process helps keep over 220 million end-of-life tires out of landfills every year.

Why do concerns still exist around using recycled rubber materials in public places like parks and playgrounds?

Most skepticism about recycled rubber comes from a lack of information. Many people do not know how tires are recycled, what is in the end material, or how rigorously it is tested.

The reality is that this is one of the most tested products in America today. The Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention (CDC) and the Consumer Product Safety Commission (CPSC) recently did a study on recycled rubber infill used in turf fields, and they found no significant differences in exposure levels when compared to playing on grass. Just last month, California published a similar study finding no significant health concerns. The scientific process worked exactly as it should, and that is why communities across the country are embracing surfaces using recycled rubber.

The more people learn about recycled rubber, the more they understand its value. People love what it offers to high quality, accessible and safe parks, playgrounds and playing fields.

The Better Play Initiative was created with the purpose of making the science and research around recycled rubber more accessible and available to policymakers, community leaders and citizens who need factual information about this material.

So much of this information exists out there, and we put much of it in one place so that it is easily accessed.

What does science say about exposure to recycled rubber materials in public settings?

The science behind recycled rubber is definitive and consistent. More than 100 peer reviewed studies, including those published by the EPA, the CDC and the CPSC, have evaluated recycled rubber. These studies show recycled rubber is safe, and there are no significant impacts.

These studies have examined potential exposure pathways, including ingestion, inhalation and skin contact. We believe communities, parents and policymakers should have access to this information when making decisions about recreation spaces.

What quality control measures ensure recycled rubber products are safe and consistent?

The recycled rubber industry follows strict quality control protocols throughout the manufacturing process. The processing facilities use multi-stage cleaning systems and sophisticated sorting equipment to ensure consistent particle size and purity.

Many manufacturers perform regular testing on their products to verify performance and composition. Additionally, products used in settings like playgrounds and athletic fields must

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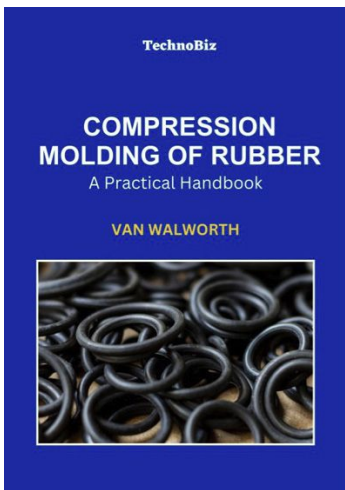
meet industry standards for impact attenuation, drainage and durability. These standards help ensure consistent quality and performance across installations.

What new research, data or innovations in recycled rubber are you following or excited about?

We are seeing advances in installation techniques that help improve drainage and overall performance. There are new processing methods that allow for more consistent recycled rubber materials. New research continues to be published in support of recycled rubber use. For example, the recent CalEPA study examined the potential health risks associated with synthetic turf fields, ultimately finding no significant health risks to players, coaches, referees and spectators from on-field or off-field exposure.

Do you have any final thoughts on recycled rubber?

Recycled rubber has transformed the way communities create safe and accessible recreational spaces. The safety record of facilities utilizing recycled rubber, combined with its durability and cost-effectiveness, make it an indispensable material for playgrounds and sports fields. By supporting recycled rubber, we are not just investing in better playing surfaces, we are investing in healthier, more active communities and a more sustainable future.



Compression Molding of Rubber – A Practical Handbook

“Compression Molding of Rubber – A Practical Handbook” is the second book by Van T. Walworth, building upon rubber industry technology and know-how. This book focuses specifically on the technical aspects Van considers to be fundamental principles of compression molding of rubber products.

Some of the information presented in this book will be obvious and well known to many rubber molding practitioners, while at the same time, much of the content discussed in this book will not necessarily be considered basic, or even obvious, to those skilled in compression molding technology. From Van’s point of view, compression molding has not been replaced by transfer molding or injection molding, but rather, the process of molding rubber products has been expanded from compression molding to include transfer and injection molding.

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HB CHEMICAL ANNOUNCES ACQUISITION OF LIANDA CORPORATION

HB Chemical, a trusted name in rubber and chemical distribution since 1986, announced the acquisition of **Lianda Corporation**, a highly respected distributor of specialty polymers.

Founded in 1995, Lianda has built an impressive legacy over the past 30 years—one grounded in deep technical knowledge, a carefully curated product portfolio, and an unwavering commitment to customer success. Under the leadership of Lee Mao and Shawn Xu, Lianda became a go-to partner for high-performance materials across North America. Their vision, hard work, and passion have shaped a company that has earned the trust of both customers and suppliers alike.

“This is more than an acquisition—it’s the coming together of two companies that share a common

culture of customer dedication and service excellence,” said Joe Moran, General Manager of HB Chemical. “We have admired Lianda’s position in the specialty polymer space for years, and we are thrilled to bring their products and expertise into our growing platform.”

“It is a very emotional decision after 30 years built with soul and heart, but we know it is the right decision. We are deeply grateful for the trust, support, partnership, and friendship we have received from Lianda’s team, our customers, and principals over the past 30 years. Shawn and I are confident that the partnerships we have built with our customers and principals will continue under the leadership of Joe Moran, and our team will have more opportunities to grow at HB Chemical/Ravago,” said Lee Mao, President and CEO of Lianda.

“We are happy to see that HB Chemical/Ravago will maintain our well-equipped lab to continue providing a high level of technical support and innovative solutions to our valued customers,” said Shawn Xu, Co-President, Technology of Lianda.

The integration of Lianda into HB Chemical will enhance product offerings, technical capabilities, and geographic reach—providing customers with even greater value and service. The combined team remains laser-focused on what matters most: helping customers and principals succeed.

“We look forward to building on the incredible foundation Lianda has created and honoring the legacy Lee and Shawn have built.” said Joe Moran.



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Patent News

Plant derived polyamide based elastomer foam molded body, method for manufacturing same and foam particles thereof

U.S. patent: 12,221,521

Issued: February 11, 2025

Inventors: Daisuke Shimizu and Yuichi Gondoh

Assigned: Sekisui Plastics

Key statement: A foam molded body having a rebound resilience coefficient equivalent to that of a petroleum-derived polyamide based elastomer foam molded body, and excellent moldability during in-mold foaming; foam particles; and a method for producing the foam molded body. A polyamide based elastomer foam molded body comprising 50 to 100 mass % of a block copolymer resin containing a polyamide block as a hard segment and a polyether block as a soft segment,

wherein the copolymer resin has a biobased product content as measured by ASTM D6866 of 30% or more.

Addition curable silicone rubber composition and method for producing same

U.S. patent: 12,221,542

Issued: February 11, 2025

Inventor: Nobu Kato

Assigned: Shin-Etsu Chemical

Key statement: An addition-curable silicone rubber composition which contains: 100 parts by mass of (A) an organopolysiloxane that has at least two alkenyl groups, each of which is bonded to a silicon atom, in each molecule and wherein an alkenyl group is bonded to a silicon atom at one end or both ends of the molecular chain; 1-80 parts by mass of (B) γ -cyclodextrin; (C) an organohydrogen polysiloxane that has

at least two hydrogen atoms, each of which is bonded to a silicon atom, in each molecule in such an amount that the molar ratio of the hydrogen atoms bonded to silicon atoms (Si—H groups) to the total amount of the alkenyl groups bonded to silicon atoms in the entire composition, namely (Si—H groups)/(Si-alkenyl groups) is from 0.5 to 5.0; and a catalytic amount of (D) an addition reaction catalyst.

Process for producing a pressure-sensitive adhesive based on acrylonitrile-butadiene rubber and adhesive tape comprising said adhesive

U.S. patent: 12,221,570

Issued: February 11, 2025

Inventors: Julia Schönrock, CaiRong Lim and Yeliz Tepe

Assigned: Tesa SE

Key statement: A process for producing

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Patent News

a cured pressure-sensitive adhesive that comprises a composition including at least one solid acrylonitrile-butadiene rubber, at least one tackifier resin and optionally at least one liquid acrylonitrile-butadiene rubber, comprises subjecting the composition to electron-beam irradiation (EBC) with an acceleration voltage of 1.8 to 2.38 kV per 1 µm layer thickness of the composition and with a total beam dose of 5 to 50 kGy. Also disclosed is a cured pressure-sensitive adhesive obtained or obtainable by the process. Further disclosed is a double-sidedly adhering, especially carrierless, adhesive tape and also single- or double-sidedly adhering adhesive tape comprising, on a carrier layer, the cured pressure-sensitive adhesive. Disclosed finally is the use of the pressure-sensitive adhesive or of an adhesive tape made therefrom for bonding

components in electronic devices, especially in mobile electronic devices, preferably tablets, mobile phones or smart watches.

Acrylonitrile-butadiene rubber composition and laminate having layer of the composition

U.S. patent: 12,221,544

Issued: February 11, 2025

Inventors: Yoshiharu Kikuchi and Kotaro Ichino

Assigned: Mitsui Chemicals

Key statement: An object of the present invention is to develop an NBR composition excellent in an adhesive strength with a saponified ethylene-vinyl acetate copolymer layer and a laminate excellent in an adhesive strength of an NBR layer with a saponified ethylene-vinyl acetate copolymer layer; and the present invention relates to an acryloni-

trile-butadiene rubber composition comprising an acrylonitrile-butadiene rubber and a silane-modified ethylene-vinyl acetate copolymer of 0 to 50 parts by mass with respect to 100 parts by mass of the acrylonitrile-butadiene rubber and a laminate comprising an acrylonitrile-butadiene rubber layer comprising the composition and the saponified ethylene-vinyl acetate copolymer layer through an ethylene-vinyl acetate copolymer layer.

Tire replacement forecasting system and method

U.S. patent: 12,220,946

Issued: February 11, 2025

Inventors: Kanwar Bharat Singh and Mustafa Ali Arat

Assigned: Goodyear Tire & Rubber

Key statement: A tire replacement forecasting system includes a tire support-



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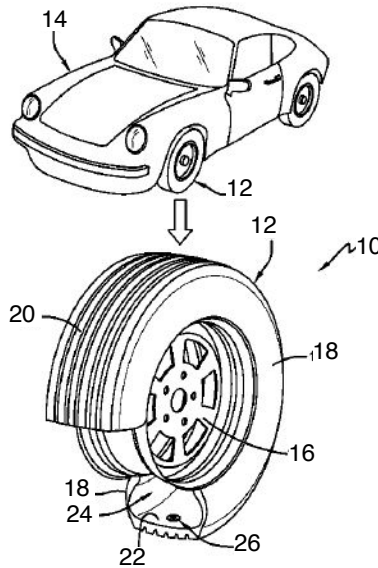
Email: email@chemtechnologiesltd.com



Patent News

ing a vehicle. A sensor unit is mounted on the tire and includes a footprint centerline length measurement sensor and a pressure sensor. A processor is in electronic communication with the sensor unit and receives the measured centerline length and the measured pressure. An electronic vehicle network transmits selected vehicle parameters to the processor. A wear state predictor is stored on the processor and receives the measured centerline length, the measured pressure and the selected vehicle parameters to generate an estimated wear state of the tire. A forecasting model is stored on the processor and receives multiple estimated wear states of the tire and predicts future wear states of the tire. A forecast tire replacement date is generated by the forecasting model when the predicted future

wear states of the tire are estimated to pass a predetermined wear threshold.



Tire

U.S. patent: 12,220,947

Issued: February 11, 2025

Inventors: Yoshifumi Kawagoe and Koichi Nakajima

Assigned: Sumitomo Rubber Industries

Key statement: A tire includes a pair of sidewall portions. An outer surface of at least one of the sidewall portions includes at least one concave mark recessed from a reference surface. The or each concave mark includes a bottom surface and an inner wall surface. The bottom surface includes a peripheral region and a main region. The peripheral region includes a shadow region and a non-shadow region. The shadow region and the non-shadow region are each formed with an uneven surface provided with minute protuber-



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NEW 16"X40" MILL



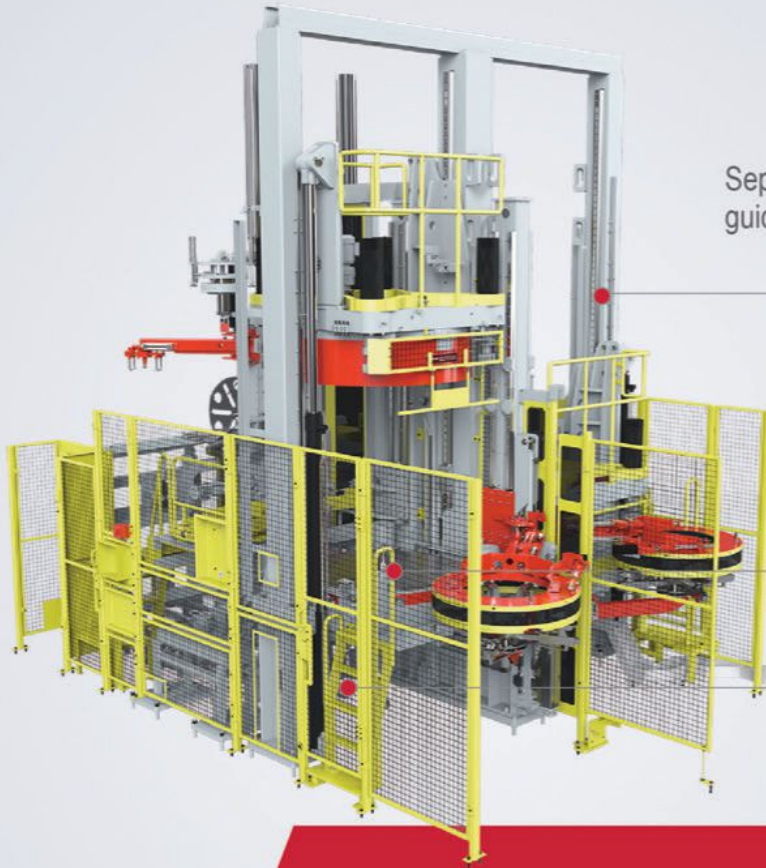
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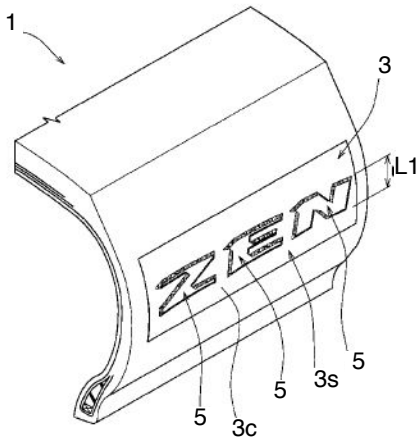


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Patent News

ances. A width of the uneven surface of the non-shadow region measured in a direction perpendicular to a contour of the or each concave mark is smaller than a width of the uneven surface of the shadow region measured in a direction perpendicular to the contour.



Conductive rubber compositions and articles composed of the same
U.S. patent: 12,234,341

Issued: February 25, 2025

Inventors: Robert Vincent, Dennis-Pelcher, Junling Zhao and Aaron Patrick Murray

Assigned: Goodyear Tire & Rubber

Key statement: Described herein are conductive rubber compositions including a rubber component and one or more electrically conductive carbon compounds. In another aspect, the conductive rubber compositions can be prepared by first adding the one or more conductive carbon components into the polymer phase, thereby creating a filler network in the continuous polymer phase in the finished product. In a further aspect, the conductive carbon component can be or include one or more of the following: carbon black, a short carbon fiber, graphite powder or graphene powder. Following mixing, the conductive rubber compositions can optionally be vulcanized. The conductive rubber compositions have good mechanical properties and electrical

resistivity and can be processed using existing equipment.

Silicone elastomers by free radical mediated cure

U.S. patent: 12,234,389

Issued: February 25, 2025

Inventors: Michele A. Craton, Rajdeep S. Kalgutkar, Kim M. Vogel and Dennis E. Vogel

Assigned: 3M Innovative Properties

Key statement: Curable compositions of this disclosure comprise a mixture of: a silanol, a free radical initiator, an iodonium salt; and optionally an alkoxysilane and/or an MQ resin and/or (meth)acrylate monomer(s). In another aspect, cured compositions of this disclosure comprise: a cured silicone, a free radical initiator or residue thereof, an iodonium salt or residue thereof; and optionally a poly(meth)acrylate and/or an MQ resin, which may comprise the cured silicone. In another aspect, cured compositions of this disclosure com-



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Patent News

this disclosure comprise: a continuous phase of cured silicone, a discontinuous phase of poly(meth)acrylate inclusions and optionally an MQ resin, which may comprise the cured silicone. The poly(meth)acrylate inclusions may have an average diameter of less than 1.0 micrometer or smaller. The compositions may be pressure sensitive adhesives. The curable and cured compositions may be solvent-free.

Cable bead, tire using cable bead, cable bead manufacturing method and cable bead manufacturing device

U.S. patent: 12,227,034

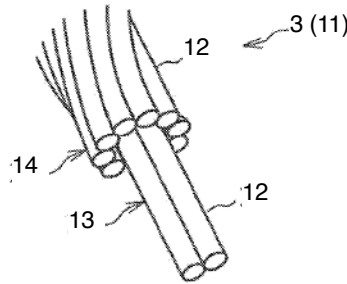
Issued: February 18, 2025

Inventor: Shoichi Ohashi

Assigned: Towaron Trading

Key statement: A cable bead compris-

ing an annular core and a side wire spirally wrapped up around the annular core, wherein the annular core is made up of a round steel wire made to circle once or made, without being stranded, to circle 2 to 10 times side by side and wherein the side wire is a round steel wire consecutive from the annular core. This provides a high strength cable bead that can press a tire main body against a wheel without fail even if a tire is charged with a high load.



Olefin based elastomer composite resin composition for airbag chute, comprising dendrimer

U.S. patent: 12,234,350

Issued: February 25, 2025

Inventors: Chang Won Chae, Sung Yeon Lee, Chang Min Hong, Jong Soo Park, Jae Myung Rhee, Jin Young Huh, Kyu Haeng Cho, Dae Keun Kim, Gwang Ho Go and Poong Hyun Choi

Assigned: Cepla

Key statement: A polyolefin thermoplastic elastomer composition for an airbag chute includes a polypropylene, an olefin block copolymer and a dendrimer as a material applied to a raw material of a passenger airbag chute. An olefin elastomer composite resin composition for an airbag chute includes 30-80 parts by weight of a polypropylene resin, 30-70 parts by weight of an olefin block copolymer

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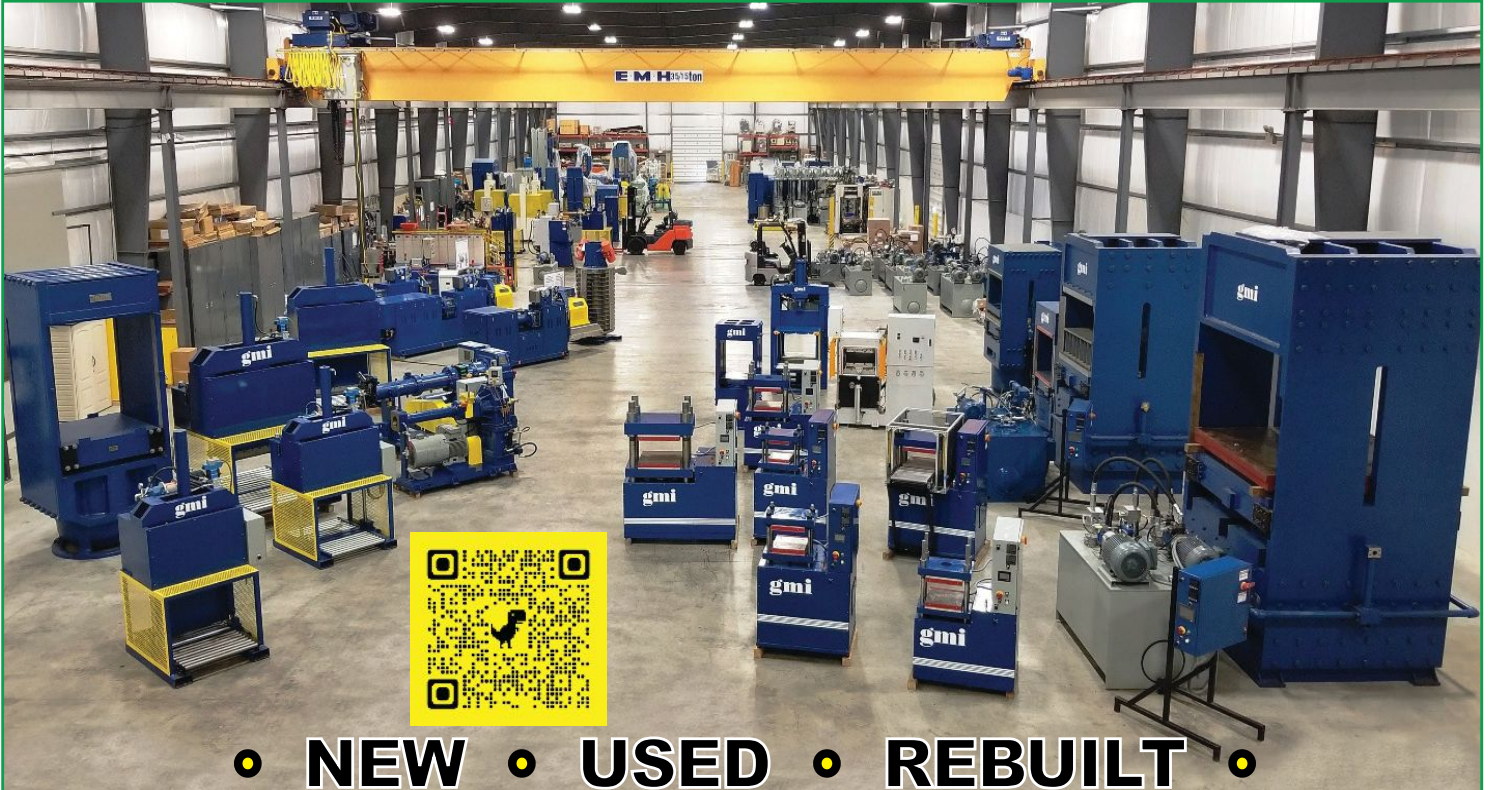
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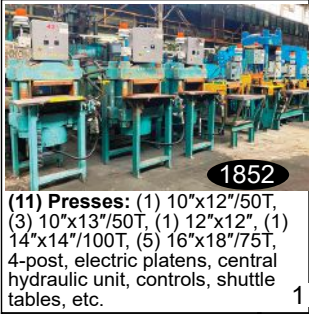
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1852

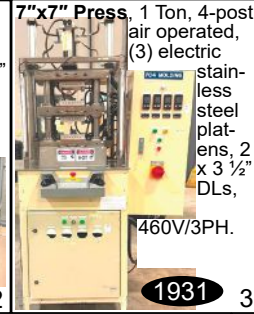
(11) Presses: (1) 10"x12"/50T, (3) 10"x13"/50T, (1) 12"x12", (1) 14"x14"/100T, (5) 16"x18"/75T, 4-post, electric platens, central hydraulic unit, controls, shuttle tables, etc.



NEW 7"x7", 20T, table mount, 4-post, top & bottom electric platens, 2" DL, 115V /1PH, hand pump.

IN STOCK!

1927



7"x7" Press, 1 Ton, 4-post, air operated, (3) electric stainless steel platens, 2 x 3 1/2" DLs, 460V/3PH.

1931



8"x8" TMP Vacuum, 5 Ton, 3" DL, 4" ø Ram, electric platens.

1653



8.25" x 8.25" Morgan, electric platens. Complete. 120V/1PH.

1609



(2) 12" x 12" WAND, 50 Ton, hydraulics, safeties, mold shuttle. Ideal for shoe insoles. Two available.

971/972



NEW 12"x12", 25 Ton, 4-post, electric platens, 8" adjustable DL, 8" stroke, fully guided, manual & auto cycles. 460V, 3PH.

IN STOCK!

1945



NEW 12"x12", 30 Ton, 4-post, electric platens, double acting ram, fully guided, Allen Bradley PLC, color HMI.

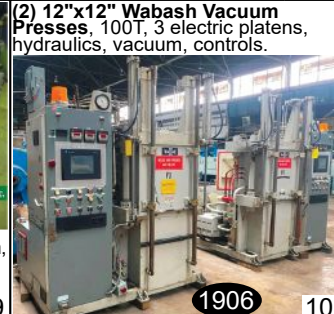
IN STOCK!

1156



(6) 12"x12" Wabash, 4" ø ram, 10" stroke, (4) 12"x12" electric platens, 2x4" DLs, valving & wiring. Missing Hydraulics.

1036



(2) 12"x12" Wabash Vacuum Presses, 100T, 3 electric platens, hydraulics, vacuum, controls.

1906



NEW 15"x15", 30 Ton, 4-post, electric platens, double acting ram, fully guided, Allen Bradley PLC, color HMI.

IN STOCK!

1157



15"x15" Wabash, 150 Ton, electric platens, 12" ø ram, 22" stroke, 10 hp hydraulics, PLC controls, table.

1867



15"x15" Wabash, 100 Ton, (4) electric platens, 2 x 3 1/2" DLs.

1943



15"x15" Wabash, 50 Ton, 2 x 6" DLs, 240V/3PH.

1379



(2) 18"x18", 140 Ton, 21" DL, 12" ø ram, side cylinders, common hydraulics.

1735



18"x18" Wabash, 100 Ton, 7" stroke, 8" DL, 240V/3PH.

1550



NEW 18"x18", 75 Ton, 4-post, electric platens, double acting ram, fully guided, Allen Bradley PLC, color HMI.

IN STOCK!

650A



NEW 18"x18", 75 Ton, 4-Post, electric platens, double acting ram, fully guided, Allen Bradley PLC, front light curtain, rear & side guarding.

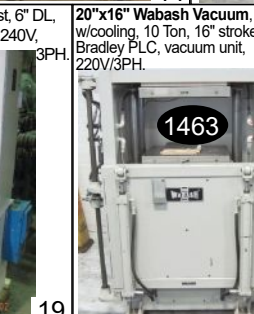
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650B



18.5"x12.5" PHI, 50 Ton, 4-post, 6" DL, 3PH, cored platens, 240V.

1333



20"x16" Wabash Vacuum, electric platens w/cooling, 10 Ton, 16" stroke, 16" DL, Allen Bradley PLC, vacuum unit, 220V/3PH.

1463



NEW 20"x20" Vacuum Press, 100 Ton, 8" DL, electric platens, self-contained vacuum system, light curtains, Allen Bradley PLC controls. Color HMI, etc.

IN STOCK!

1730



20"x22" McNeil, electric platens, 17-21" DL.

1907



24"x18" TMP, 4-post, 3 x 6" DLs, steam platens, hydraulics, controls.

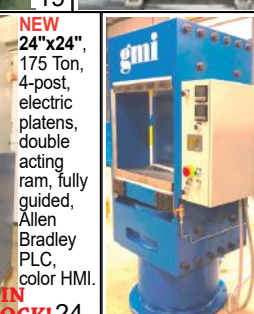
1533



NEW 24"x24", 175 Ton, 4-post, electric platens, double acting ram, fully guided, Allen Bradley PLC, color HMI.

IN STOCK!

1751



NEW 24"x24", 375 Ton, 22" stroke, 20" ø ram, 23" DL, steam platens. Hydraulics & Allen Bradley PLC controls.

IN STOCK!

1775



NEW 24"x24", 375 Ton, 22" stroke, 20" ø ram, 24" DL, electric platens. Hydraulics, Allen Bradley PLC controls.

IN STOCK!

1776



24"x24" French Oil, 55" DL, 18" ø ram, 32" stroke.

1114



24"x24" McKinnon, 300 Ton, 4-post, 18" ø ram, side cylinders, electric platens, 10" DL.

1881



24"x24" French Oil, 350 Ton, 20" ø ram, 5" DL, controls, shuttle table, hydraulics, electric platens, lifting hoist.

1813



24"x24" Empcco, 160 T, 3 x 4" DLs, 12" ram, 9" stroke, hydraulics, controls & Sterlco hot oil TCU.

1918



Rebuilt 24"x24", 350 Ton, 20" ø ram, 25" DL.

IN STOCK!

1294A



26"x32" TMP, 140 Ton, (6) electric platens w/cooling, 12" ø ram, 20" stroke, hydraulics & controls.

1916



26"x32" TMP, 140 Ton, (6) electric platens w/cooling, 12" ø ram, 20" stroke, hydraulics & controls.

1916

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<p>26"x44" Adamson, 450 Ton, 22" stroke, 78" DL.</p> <p>232</p> <p>33</p>	<p>(2) 30"x24" Erie, 20" stroke, 76" DL. Rebuilt.</p> <p>226A/B</p> <p>34</p>	<p>30"x30" French Oil, 22" stroke, 17" ram.</p> <p>1723</p> <p>35</p>	<p>NEW 30"x30", 475 Ton, 22" stroke, 22" ram, electric platens, 26" DL, hydraulics, Allen Bradley PLC controls.</p> <p>1633</p> <p>36</p>	<p>NEW 30"x30", 475 Ton, 22" stroke, 22" ram, 24" DL, steam platens, hydraulics & Allen Bradley PLC controls.</p> <p>1864</p> <p>37</p>	<p>30"x30" French Oil, 350 Ton, 20" stroke, 16" ram, 16" stroke, NEW electric platens, 19" DL. Rebuilt.</p> <p>1940</p> <p>38</p>	<p>30"x45" Erie, 20" stroke, 4-Post, 36" DL. Rebuilt.</p> <p>1553</p> <p>39</p>
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<p>32"x32" Eemco, 4-post, 32" DL, 26" stroke, 24" ram.</p> <p>1283</p> <p>40</p>	<p>32"x32" Eemco, 500 Ton, 24" stroke, 26" ram, 26" stroke, 40"/50" DLs Rebuilt.</p> <p>822A</p> <p>41</p>	<p>32"x32" Adamson, 4-Post, 600 Ton, 32" Stroke, 45" DL. Rebuilt.</p> <p>237</p> <p>42</p>	<p>32"x32" Eemco, 500 Ton, 24" stroke, 24" ram, 24" stroke, 54" DL. Rebuilt.</p> <p>822B</p> <p>43</p>	<p>32"x32" French Oil, 650T, 26" ram, electric platens, hydraulics, controls, shuttle table.</p> <p>1905</p> <p>44</p>	<p>32"x32" Adamson, 500 Ton, 24" stroke, 24" ram, 16" stroke. Rebuilt.</p> <p>1285</p> <p>45</p>	<p>36"x24" French Oil, 565 Ton, 24" stroke, 24" ram, 24" stroke, 30" DL. Rebuilt.</p> <p>1934</p> <p>46</p>
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<p>36"x36" Erie, 500 Ton, 4-post, 24" stroke, 15"/22" ram, 12"/37" DL.</p> <p>823</p> <p>47</p>	<p>NEW 36"x36", 700 Ton, 22" stroke, electric platens, 26" DL, hydraulics & Allen Bradley PLC controls.</p> <p>1796</p> <p>48</p>	<p>NEW 36"x36", 700 Ton, 22" stroke, 26" ram, 25" DL, steam platens, hydraulics & Allen Bradley PLC controls.</p> <p>1635</p> <p>49</p>	<p>36"x36" Bolling, slab sides, 53" DL w/o platens, 24" stroke, 36" ram, 36" stroke, 39" between sides, 63" work height. Rebuilt.</p> <p>1960</p> <p>50</p>	<p>36"x168" Belt Press, 1000 Ton, 7 x 13" rams, 30" DL. Rebuilt.</p> <p>1750</p> <p>51</p>	<p>38"x30" French Oil, 800 Ton, 30" stroke, 30" ram, 24" stroke, 30" DL. Rebuilt.</p> <p>1287</p> <p>52</p>
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<p>(3) 40"x20" Eemco, 250 Ton, 4-Post, 2 x 12" rams, 20" stroke, 18" DL, steam platens.</p> <p>239/1089</p> <p>53</p>	<p>42"x42" Erie, 800 Ton, 4-post, 30" ram, 28" stroke, 48" DL.</p> <p>1132</p> <p>54</p>	<p>NEW 42"x42", 850 Ton, 30" stroke, 24" ram, 24" stroke, steam platens, 26" DL, etc.</p> <p>1745</p> <p>55</p>	<p>42"x42" Fjellman, 55" DL, 900 Ton, hydraulics & controls.</p> <p>244</p> <p>56</p>	<p>(3) 42"x42" French Oil, 25" stroke, 16" ram, 24.5" DL. Rebuilt.</p> <p>1527</p> <p>57</p>	<p>42"x42" French Oil, 1250 Ton, 36" ram, 14" stroke, 19" DL. Rebuilt.</p> <p>1470</p> <p>58</p>
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<p>NEW 42"x42", 850Ton, 22" stroke, 30" ram, 26" DL, steam or electric platens, hydraulics & Allen Bradley PLC controls.</p> <p>1797</p> <p>59</p>	<p>45"x42", 1250 Ton, 36" ram, 32" stroke, 38" DL.</p> <p>1136</p> <p>60</p>	<p>46"x46" 4-Post, 100 Ton, 10" stroke, 26" DL, hydraulics & controls.</p> <p>1917</p> <p>61</p>	<p>NEW 48"x132", 1200 Ton, 4 x 18" cylinders, 18" stroke, steam/oil platens, 24" daylight, NEW hydraulics, NEW Allen Bradley PLC controls, NEW TCU.</p> <p>1963</p> <p>62</p>	<p>NEW 48"x48", 1250 Ton, 30" stroke, 36" ram, 33" DL, steam or electric platens, hydraulics & Allen Bradley PLC Controls.</p> <p>1798</p> <p>63</p>
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<p>48"x48", 4-post, 18" stroke, 18" ram, 18" stroke, 42" DL.</p> <p>249</p> <p>64</p>	<p>48"x96" Eemco, 2000 Ton, 8-post, 2x32" rams, 26" stroke, 29" DL. Rebuilt.</p> <p>1152</p> <p>65</p>	<p>(2) 50"x26" French Oil, 550 Ton, 4-post, 24" ram, 26" stroke, 36" DL.</p> <p>1639/1640</p> <p>66</p>	<p>52"x48" Bolling, slab sides, 30" stroke, 30" ram, 32" stroke, 60" DL w/o platens, 55" between sides. Rebuilt.</p> <p>1961</p> <p>67</p>	<p>54"x42", 1500 Ton, 40" stroke, 24" ram, 24" stroke, 32" DL. Rebuilt.</p> <p>1208</p> <p>68</p>	<p>54"x46" Erie, 1250 Ton, 38" stroke, 36" ram, 30" stroke, 36" DL. NEW side cylinders, hydraulics, & PLC controls. Rebuilt.</p> <p>250</p> <p>69</p>
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NEW & USED PRESSES

IN STOCK

56"x52" Adamson, 1000 Ton, 32" ø ram, 26" stroke, 30" DL w/o platens. Re-built. IN STOCK!
1820 70

60"x24" Press, 100 Ton, 2 x 7" ø rams, (3) steam platens, 2 x 6" DLs, hydraulics & controls.
1892 71

NEW 60"x60", 1570 Ton, 40" ø ram, 40" DL, steam platens, 30" stroke. Hydraulics & Allen Bradley PLC controls.
IN STOCK!
1638 72

NEW 64"x64", 2250 Ton, 48" ø ram, 28" stroke, steam platens, 52" DL, 76" between sides. Hydraulics & Allen Bradley PLC controls
IN STOCK! 1942 73

NEW 64" x 64", 1700 Ton, 4 x 20" ø rams, 40" DL, steam platens, 40" stroke. Hydraulics & Allen Bradley PLC controls.
IN STOCK!
1644 74

NEW 66"x12", 100 Ton, 3 x 6" ø cylinders, 12" stroke, down-acting, steam platens, 12" DL. Hydraulics & controls.
IN STOCK!
1331 75

78"x360" Belt Press, 28 x 10" ø rams, steam platens, 11" DL, 28 posts, etc.
1124 76

NEW 80" x 80", 2350 Ton, 4x24" ø rams, 52" DL, steam platens, 40" stroke. Hydraulics, Allen Bradley PLC controls.
IN STOCK!
1646 77

NEW 80"x98", 2750 Ton, 2 x 26" ø cylinders, 36" stroke, steam/oil platens, 57" DL. NEW hydraulics, NEW Allen Bradley PLC controls.
1964 IN STOCK!
78

84"x44" Empco, 24" ø cylinder, 16" stroke, electric platens, 21" DL, hydraulics & PLC controls.
1847 79

98 1/2" x40 1/2", 180 Ton, 8x5" ø cylinders, 24" stroke, (6) hot oil platens, 5x4 1/2" DLs, hydraulics & controls, TCU.
1835 80

90"x204" Farrel Belt Press, (12) 10" ø rams, steam platens, 16" DL.
1096 81

(2) 100"x40" Erie, 1100 Ton, 2 x 24" ø cylinders, 18" stroke, 18"-20" DL. Rebuilding in progress...
1874/1875 82

104"x54" Columbia, 600 Ton, 4-post, 2 x 18" ø rams, 36" stroke, 9 x 5" DLs, (10) hot oil platens, etc.
1816 83

110"x50" Kalmag, 500 Ton, 4 x 10.5" ø rams, 26" DL. Hydraulics & controls.
1625 84

NEW HYDRAULIC UNITS / CONTROLS / PLATENS / SEALS

IN STOCK

NEW STEAM & ELECTRIC HEATING PLATENS
IN STOCK!
• 12" x 12"
• 15" x 15"
• 18" x 18"
• 20" x 20"
• 24" x 24"
• 30" x 30"
• 32" x 32"
• 36" x 36"
• 40" x 40"
• 42" x 42"
• 48" x 48"
• 60" x 60"
• 64" x 64"
• 80" x 80"

NEW IN STOCK!
• HYDRAULIC UNITS
• CONTROL PANELS
• HEATING PLATENS
• U-CUP SEALS TO RETROFIT YOUR PRESS

NEW HYDRAULIC UNITS
• 18GAL/3HP/5.5GPM | 18GAL/7.5HP/8GPM
• 34GAL/10HP/14GPM
• 60GAL/10HP/30GPM
• 100GAL/15HP/40GPM
• 150GAL/20HP/60GPM
• 200GAL/25HP/77GPM
• 300GAL/15HP/20HP/130GPM
• 400GAL/15HP/20HP/160GPM
• 500GAL/20HP/20HP/150GPM
• 600GAL/20HP/20HP/150GPM

IN STOCK!

NEW 75 KW Oil Heating "TCU", M2B-6017, 1-zone, high capacity, dual element heater, 100-550°F, 5HP motor/pump, 50 PSI, 90 GPM, 460V/3PH.
1607 IN STOCK! 85

NEW Press Control Panel, AB PLC, color HMI, auto/manual, bumping, dual palm close, temp. controllers, fused disconnect, motor starter, solid state relays, etc.
1057 IN STOCK! 86

NEW Portable Oil Filtering Cart
IN STOCK!
1841 87

NEW 18 & 34 Gallon, 5.5-14 GPM, 2500 PSI, 3-10 hp, valves, filter, etc.
1779 IN STOCK! 88

NEW 60 Gallon, 10 HP, 30 GPM, 2500 PSI, valves, filter, etc.
1744 IN STOCK! 89

NEW 100 Gallon, 15 HP, 40 GPM, 2500 PSI, valves, filter, etc.
1607 IN STOCK! 90

NEW 150 Gallon, 60 GPM, 2500 PSI, 20 HP, dual pump, valves, filter, etc.
IN STOCK!
1348 91

NEW 200 Gallon, 25 HP motor, dual pump, 77 GPM, 2500 PSI, valves, filter, etc.
IN STOCK!
1631 92

NEW 300 Gallon, 15HP/110GPM, 20HP/20GPM, 2500 PSI.
1608 IN STOCK! 93

NEW 400 Gallon, 20/15 HP, 160 GPM, 3000 PSI, valves, filter, etc.
IN STOCK!
1454 94

NEW 500 & 600 Gallon, 20HP/9GPM @ 3000 PSI & 20HP, 147GPM @ 200 PSI, valves, filter, etc.
1743 IN STOCK! 95

NEW GUILLOTINE CUTTERS IN STOCK

<p>NEW 18", 2 1/2 Ton @ 80 PSI, 18" blade, Two Pneumatic Cylinders, 10" Stroke. IN STOCK!</p> <p style="text-align: center;">1832</p> <p style="text-align: right;">96</p>	<p>NEW 32" L-r x 20"</p> <p style="text-align: center;">1812</p> <p style="text-align: right;">97</p>	<p>32"x20" 4-Way, f-b blades, 16" DL, 16" stroke, hydraulics, 16 Ton.</p> <p style="text-align: center;">1141</p> <p style="text-align: right;">98</p>	<p>NEW 32", 25" stroke, 10 hp hydraulics, 15.7 Ton. IN STOCK!</p> <p style="text-align: center;">1823</p> <p style="text-align: right;">99</p>	<p>NEW 32" Elevated, 24" DL, 24" stroke, 10 hp hydraulics, 15 Ton. IN STOCK!</p> <p style="text-align: center;">1757</p> <p style="text-align: right;">100</p>	<p>NEW 48", 30" DL, 30" stroke, 25 Ton. IN STOCK!</p> <p style="text-align: center;">1941</p> <p style="text-align: right;">101</p>
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NEW 26LT & 60 LT PREFORMERS IN STOCK NEW SILICONE CURING OVEN

<p>IN STOCK!</p> <p>NEW 26 Lt & 60 Lt. Preformers, +/- 1% accuracy, weighing scale with close loop feedback, 3000 PSI, 0-400 RPM servo cutter, 900/1800 Lbs/hr.</p> <p style="text-align: center;">1648A</p> <p style="text-align: right;">102</p>	<p>NEW Rotating Cooling Conveyor IN STOCK!</p> <p style="text-align: center;">1648B</p> <p style="text-align: right;">103</p>	<p>NEW Silicone Curing Oven, infrared heat, 3' hi heat zone @ 1200° F, 13' cure zone @ 570° F, 6" conveyor, variable speed, on rollers for easy installation.</p> <p style="text-align: center;">1367</p> <p style="text-align: right;">104</p>
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NEW 16" x 40" MILL NEW 3 1/2" EXTRUDER NEW DOSING & WEIGHING SYSTEM

<p>NEW 16" x 40", roller bearings, motorized roll adjustment, tilting stock guides, 1.27:1 friction, direct drive, cutting knives, 60HP ABB variable speed motor & drive, rotary joints, stainless steel pan, auto grease lube, overhead/belly/kick safeties, unitized base, etc.</p> <p style="text-align: center;">1729</p> <p style="text-align: right;">105</p>	<p>NEW 3 1/2", cold feed, 12:1 L/D, power roll feed, direct drive, variable speed, 50HP AC motor/drive, straight head w/ pressure & temp transducer. IN STOCK!</p> <p style="text-align: center;">1773</p> <p style="text-align: right;">106</p>	<p>NEW Dosing & Weighing System, plastic FIFO storage bins, bag elevator & sliding cart, bin loading hopper, rear platform, 10-station rotational carousel, control station, RF cards & reader, bar code printer, scale, computer, etc. IN STOCK!</p> <p style="text-align: center;">1647</p> <p style="text-align: right;">107</p>
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NEW & USED CALENDERS IN STOCK

<p>6" x 13" Farrel, 3-roll, vertical, chromed rolls, 5 HP variable speed motor & drive, unitized, on rollers.</p> <p style="text-align: center;">1447</p> <p style="text-align: right;">108</p>	<p>8"x16" Farrel, 4-roll, inverted-L, 15 HP DC variable speed motor & drive, unitized.</p> <p style="text-align: center;">1391</p> <p style="text-align: right;">109</p>	<p>8" x 16" Farrel, 3-roll, vertical, 10 hp dc motor, SCR drive, lube, unitized.</p> <p style="text-align: center;">793</p> <p style="text-align: right;">110</p>	<p>8"x25" Nippon, 2-roll, even gears, 5 hp variable speed motor & drive. IN STOCK!</p> <p style="text-align: center;">1898</p> <p style="text-align: right;">111</p>
<p>10" x 20" Getty, 3 rolls, inverted L, bull gear & pinion, varispeed drive, unitized.</p> <p style="text-align: center;">396</p> <p style="text-align: right;">112</p>	<p>12"x30" Albert, 3-Roll, Falk reducer, 50HP VS motor/drive, friction & non-friction gears, unitized.</p> <p style="text-align: center;">1897</p> <p style="text-align: right;">113</p>	<p>16"x40" Silicon Calender, 3-Roll, motorized top roll, 15 hp dc motor & drive, unitized. Nice!</p> <p style="text-align: center;">1902</p> <p style="text-align: right;">114</p>	<p>NEW 14"x44" Calender, 3-roll, straight vertical, roller bearings, motorized gap adjustment, nylon guides, 60HP/480V/3PH ABB motor & variable speed drive, control panel, unitized. IN STOCK!</p> <p style="text-align: center;">1880</p> <p style="text-align: right;">116</p>
<p>18" x 52" Farrel, 3-roll vertical, Right Angle reducer, 50 hp motor, unitized.</p> <p style="text-align: center;">712</p> <p style="text-align: right;">117</p>	<p>24" x 66" Farrel, 3-roll, Motorized Roll Adjustment, Falk Reducer, 150 HP dc motor, wind/take-up rolls.</p> <p style="text-align: center;">399</p> <p style="text-align: right;">118</p>	<p>24"x 68" Farrel, reducer, bull gear & pinion, SCR drive, motorized roll, 100 HP DC motor.</p> <p style="text-align: center;">1206</p> <p style="text-align: right;">119</p>	<p>(10) 28" Ø X 74" & (4) 32" Ø X 88", peripherally drilled rolls for cooling or heating, chrome or tungsten carbide finish, 18.5"/19"/21.5" Ø journals. Rolls are new or rebuilt. Bearing housings available. IN STOCK!</p> <p style="text-align: center;">753</p> <p style="text-align: right;">120</p>

USED INJECTION PRESSES

IN STOCK

<p>(3) Gluco 20"x18", vertical injectors, 20" x 18" electric platens, hydraulics, Qty 3.</p> <p>1792</p> <p>121</p>	<p>48 Ton Rutil Silicone, 400 cm3, vertical.</p> <p>1119</p> <p>122</p>	<p>5 Ton Toshiba LSR, horizontal, 9"x9" platens, 0.21 oz shot.</p> <p>1615</p> <p>123</p>	<p>40 Ton Battenfeld, silicone LSR, 60cc, horizontal, 19.25"x12.5" electric platens.</p> <p>1728</p> <p>124</p>	<p>180 Ton Desma, D968.160F, vertical, 220 cc, 15"x15" platens. Four available.</p> <p>1321A</p> <p>125</p>	<p>LWB Steini, # GIP CE-O, 100cc, 22 Ton, vertical, 12"x12" platens.</p> <p>1405</p> <p>126</p>
<p>LWB Steini, # VCE-T, 160 cc, 27 Ton, vertical, 12" x 12" platens.</p> <p>1585</p> <p>127</p>	<p>250 Ton Desma, D968.250T, vertical, 1000 cc, 26.5" x 32" platens.</p> <p>1761</p> <p>128</p>	<p>1L/180T LWB Steini, VRE 1600/1000, 1000 cc, 180 Ton, vertical, 20" x 20" platens. Used for demo only.</p> <p>1840</p> <p>129</p>	<p>100 Ton REP, horizontal, 500cc, 14"x14" electric platens.</p> <p>1778</p> <p>130</p>	<p>170 Ton Desma, D968.160-ZO, vertical, 220 cc, 18"x20" platens. Fully automated.</p> <p>1288</p> <p>131</p>	
<p>350 Ton Rutil, vertical, 4 Lt. 25"x33" electric platens.</p> <p>1774</p> <p>132</p>	<p>(3) 180 Ton Desma, D968.160F, 220 cc, 15"x15" platens. Fully automated for rubber/metal. Three available.</p> <p>1321B/C/D</p> <p>133</p>	<p>400T/2500CC Maplan, MHF 2500/400, SN 1190099, horizontal, 28"x40" electric platens, 400 Ton, 2500 cc, electrical panel. Mfd 2000.</p> <p>1935</p> <p>134</p>	<p>(2) 700 Ton Rutil, vertical, electric platens, hydraulics & controls.</p> <p>1523A/C</p> <p>135</p>		

USED INTERNAL MIXERS

IN STOCK

<p>Farrel 1.5 Lt Banbury®, 30/15 hp motor, dual speed, air cylinder, oil lube, valves & gauges, controls, 480V/3PH.</p> <p>1959</p> <p>136</p>	<p>Farrel 1.5 Lt Banbury®, 30 hp dc motor, variable speed drive, air cylinder, controls, 480V/3PH.</p> <p>1956</p> <p>137</p>	<p>1.5 Lt. Farrel Banbury® "BR", 25HP motor, 4-speed, unitized, 220V/3PH.</p> <p>1603</p> <p>138</p>	<p>1.5 Lt. Farrel Bridge Banbury®, central lube, air cylinder, controls, RPM meter, unitized.</p> <p>1962</p> <p>139</p>	<p>1.5 Lt. Stewart Bolling, 30HP motor, unitized, 460V/3PH.</p> <p>1763</p> <p>140</p>	
<p>"00M" Kobelco, 1.66 Lt, 2-wing, 30HP AC motor, variable speed, controls, air operated door, safety guards.</p> <p>1818</p> <p>141</p>	<p>8 Lt. Farrel Banbury® "OO", batch & temp. gauges unitized.</p> <p>1755</p> <p>142</p>	<p>3 Lt Farrel Banbury® "OOC", 40HP motor, variable speed, controls, lube, unitized.</p> <p>1849</p> <p>143</p>	<p>16.5 Lt Farrel Banbury®, drop door, 150HP motor/starter, reducer, hydraulics, electricals, unitized.</p> <p>1441</p> <p>144</p>	<p>16.5 Lt. Farrel #1A Banbury®, slide door, 100 HP motor, Reliance variable speed drive, direct drive, auto lube, unitized.</p> <p>1865</p> <p>145</p>	<p>16.5 Lt. Farrel #1 Banbury®, Swingside door, 125/62.5 HP motor, Reducer, Direct drive, Auto lube, Unitized.</p> <p>1777</p> <p>146</p>
<p>16.5 Lt. Farrel #1-D Banbury®, drop door, direct drive, 200 HP DC Motor/Drive, operator platform.</p> <p>1762</p> <p>147</p>	<p>70 Lt Guix-745 Banbury®, drop door, 250/125 HP motor, direct drive, reducer, controls.</p> <p>1404</p> <p>148</p>	<p>70.5 Lt Farrel Banbury®, slide door, 200HP/440V motor, bull gear & pinion, auto/central lube, unitized.</p> <p>1920</p> <p>149</p>	<p>Farrel F-80 Mixing Line, 80 Lt Banbury®, drop door, drilled sides, roller bearings, FYH dust stops & end plates, 2-wing rotors, 300/150 hp motor, variable speed drive, lube, controls, 480V/3PH</p> <p>1919</p> <p>150</p>	<p>270 Lt. Farrel F270-T Banbury® Body & Hopper, undrive, roller bearings, 2-wing rotors, chromed interior, FYHT dust seals, sliding hydraulic door, grease lube, feed hopper, 22" air cylinder, spare rotors & end plates.</p> <p>1753</p> <p>151</p>	

USED AUTOCLAVES

IN STOCK

<p>12"ø x 32", AAA Welding, 12"ø x 36" L, NB # 1064, 100PSI/350F, quick opening door, hydraulic cylinder & valving.</p> <p>1839</p> <p>152</p>	<p>36" ø x 120" L WSF, 125 PSI, NB # 14139, quick locking/opening door.</p> <p>1105</p> <p>153</p>	<p>36" ø x 55" L United-McGill, 110 PSI, NB # 184, Quick open door, boiler, unitized.</p> <p>1549</p> <p>154</p>	<p>40" ø x 204" L WSF, 85 PSI, NB # 9475, quick open door.</p> <p>1481</p> <p>155</p>	<p>48" ø x 168" L WSF, 125 PSI, NB # 15735, quick open door.</p> <p>1106</p> <p>156</p>
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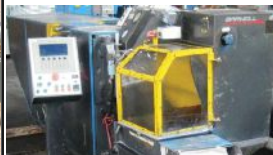
NEW & USED EXTRUDERS & PREFORMERS IN STOCK

1 Lt Rubber Extruder/Preformer, 2'Ø barrel w/ vacuum, 15 Ton, 3000 PSI, water cooling/heating, 480V/3PH.



1929 157

Barwell Preformer, HT2000, variable speed conveyor, multiple speed cutter, front & rear loading, Spare parts.



1540 158

1" Royle Extruder/Pelletizer, cold feed, 16:1 L/D, 5 HP variable speed motor/drive, on rollers.



1736 159

2" Davis Std, 12:1 L/D, cold feed, power roll feed, 5 hp motor & variable speed drive, unitized.



1888 160

2" NRM CoExtrusion Line, 12:1 L/D, cold feed, variable speed, TCU, dual cross heads, conveyor take-up, cooling drum & winding units.



161 161

2" Royle, cold feed, 11:1 L/D, 7.5 HP variable speed, reducer, straight head, unitized.



1765 162

2" Coextrusion Line, cold feed, 10 hp dc drive, double cross extrusion. Conveyor take-up, Roller Die, Multi-drum cooling unit, Budzar 3 zone TCU, etc. Complete line.



1667 163

2" Royle, cold feed, 12:1 L/D, 7.5 HP variable speed, 440V/3PH, reducer, straight head, unitized.



1417 164

(2) 2 1/2" Extruders, cold feed, 12:1 L/D, power roll, 50HP AC motor & VS drive, straight head.



1896 165

2 1/2" Remco, cold feed, 12:1 L/D, 30 HP DC motor, straight head, SCR drive, controls.



1570 166

2.5" NRM, cold feed, 12:1 L/D, 40 HP DC motor.



1828 167

2 1/2" NRM Silicone Extrusion & Curing Line, power roll feed, 12:1 L/D, chiller, 40 hp dc motor & SCR drive, continuous silicone curing oven, etc.



1883 168

2 1/2" Remco, 12:1 L/D, cold feed, Lufkin reducer, 30 hp motor & controls, swing/clamp head, unitized. Missing VFD.



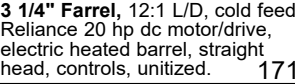
1915 169

2 1/2" Davis Standard, 12:1 L/D, power roll feed, straight swing head, 30HP dc motor & drive, controls.



1863 170

3 1/4" Farrel, 12:1 L/D, cold feed, Reliance 20 hp dc motor/drive, electric heated barrel, straight head, controls, unitized.



1178 171

3 1/2" Troester Extrusion & Curing Line, power roll feed, 16:1 L/D, 60 hp dc motor & SCR drive, 20' microwave oven followed by 90' conventional oven.



1887 172

3 1/2" Royle, cold feed, 13:1 L/D, belt driven 60HP/460V AC motor, controls w/ variable speed drive, quick swing head.



1836 173

NEW 3 1/2", cold feed, 12:1 L/D, power roll, direct drive, variable speed, 50HP AC motor/drive, straight head w/ pressure & temp transducer.



1773 174

(2) 3 1/2" NRM, cold feed, 17:1 L/D, vacuum vented, power roll feed, 75 hp ac motor & vs drive, unitized.



1783/1784 175

(2) 3 1/2" Mitsuba, 17:1 L/D, cold feed, power roll feed, unitized, 75HP/460VAC motor. Missing drive & controls.



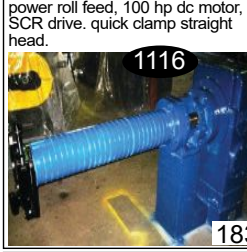
1879 176

3 1/2" Krupp, 20:1 L/D, power roll feed, vacuum vented, straight swing head, TCUs, unitized. Motor & controls not included.



1227 177

3 1/2" Royle, cold feed, 20:1 L/D, power roll, quick clamp head w/ heating, variable speed motor/drive.



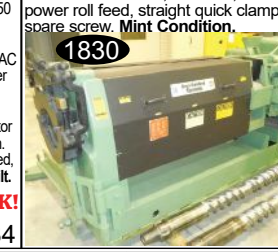
178 178

3 1/2" NRM, cold feed, 16:1 L/D, power roll, 50 hp motor, straight head, vs drive, unitized.



1764 179

4 1/2" Royle, cold feed, 15:1 L/D, power roll feed, 100 hp dc motor, quick clamp straight head.



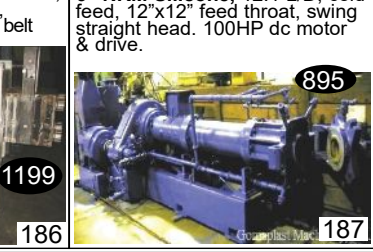
1416 180

4 1/2" Erie, cold feed, 15:1 L/D, rotary joint, straight head, unitized. No motor or electricals.



1485 181

4 1/2" Royle, cold feed, 15:1 L/D, power roll feed, 60HP DC motor & drive, quick swing clamp head.



1837 182

4 1/2" Royle, cold feed, 15:1 L/D, power roll feed, 100 hp dc motor, SCR drive, quick clamp straight head.



1116 183

4 1/2" Royle, cold feed, 12:1 L/D, power roll feed, 50 HP motor, NEW AC inverter drive, NEW operator station, Unitized, Rebuilt.



1666 184

6" Davis Standard, 12:1 L/D, cold feed, power roll feed, straight quick clamp head, spare screw. Mint Condition.



1830 185

6" Davis Standard, silicone extruder, 10:1 L/D, cold feed, power roll, straight head, 60 hp dc motor, belt drive.



1199 186

6" NRM Silicone, 12:1 L/D, cold feed, 12"x12" feed throat, swing straight head. 100HP dc motor & drive.



895 187

8" Erie, 5:1 L/D, 9"x12" feed throat, swing straight head. 200HP dc motor, pelletizing head.



1845 188

10" Black & Clawson, cold feed, 10:1 L/D, 13" x13" feed opening, 200HP/460V motor. Unitized.



925 189

12" Farrel, 5:1 L/D, 16" x 21" feed opening, 300 HP dc motor, direct drive, 70" sheeter head, unitized.



1175 190

20" x 46" Farrel Roller Die, 20" x 24" extruder, 900 hp dc motor 2-roll



998 191

NEW & USED MILLS

IN STOCK

(2) 3"x8" Reliable, chromed rolls, knee & overhead safeties, 1 1/2 hp variable speed drive.



1375



1930
6"x12" Thropp Mill, 7.5HP/220V/440V gear motor/drive, knee & overhead safeties, pushbutton station.

192



717
6"x12" Farrel, variable speed drive, split guides, knee safeties.

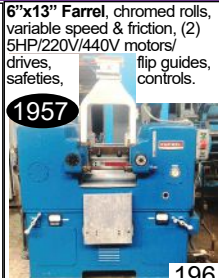
194



6"x13" Eemco, chromed rolls, 7.5HP/230V/460V motor & starter, grease lube, safeties, controls.

1953

195



6"x13" Farrel, chromed rolls, variable speed & friction, (2) 5HP/220V/440V motors/drives, safeties, flip guides, controls.

1957

196



6"x13" Bolling, dual variable speed drives, flip guides, overhead & knee safeties.

792



6"x13" Thropp, 5 HP motor/drive, safeties.

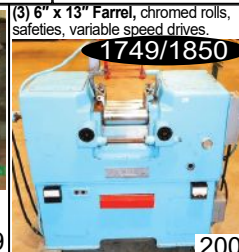
1453



6"x12" Reliable, 7.5 HP motor, rotary joints, adjustable/split stock guides.

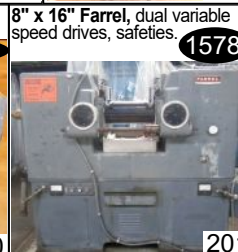
1411

198



(3) 6" x 13" Farrel, chromed rolls, safeties, variable speed drives.

1749/1850



8" x 16" Farrel, dual variable speed drives, safeties.

1578

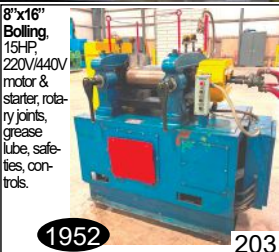
201



8"x16" Farrel, variable speed motor/drive, rotary joints, flip stock controls.

1958

202



8"x16" Bolling, 15HP, 220V/440V motor & starter, rotary joints, grease lube, safeties, controls.

1952

203



8" x 16" Farrel, heavy duty, chromed rolls, chain driven.

1810

204



NEW 16" x 40", roller bearings, motorized rolls, tilting guides, 1.27:1 friction, direct drive, cutting knives, 60HP ABB VS motor/drive, grease lube, safeties, unitized etc.

1729 IN STOCK!

205



18"x48" Farrel, 50HP/440V motor, direct drive, 48:1 reducer, flip-up stock guides, motor starter, unitized.

1932

206



22"x60" Albert, 150HP/460V motor & starter, Jones 40:1 reducer, direct drive, air brake, central grease lube, 2-piece base.

1946

207



22"x60" Farrel Mill & Stock Blender, 200HP, 460V motor & variable speed drive, 30:1 reducer, direct drive, safeties, unitized.

1937

208



22"x60" Farrel, 150HP/440V motor, bull gear & pinion, 6.92:1 reducer, safeties, motor starter, 2-piece base.

1933

209



26"x84" Bolling, direct drive, 84.2:1 reducer, two piece base, 250HP/460V motor, starter, controls.

1112

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1197

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Patent News

and 0.1-5 parts by weight of a dendrimer based on 100 parts by weight of the olefin elastomer composite resin composition. The olefin elastomer composite resin composition for an airbag chute improves the dispersion of the elastomer by applying a high-flow elastomer and a low-flow polypropylene and improves flowability and meltability characteristics without deteriorating physical properties by applying the dendrimer.

Recycled rubber barrier

U.S. patent: 12,221,754

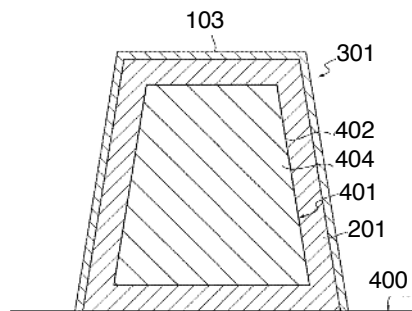
Issued: February 11, 2025

Inventors: Eric Davis and Richard K. Welle, IV

Assigned: Pretred

Key statement: A barrier includes recycled rubber portions molded around a core infrastructure. The core infrastructure may itself include recycled rubber in a containment body. The

containment body may include baled recycled or other waste material. The barriers may be stacked or connected to form a barrier structure useful in environmental control and other applications. The method for making the barriers includes molding rubber portions and a binder around a core infrastructure.



Functionalized rubbers

U.S. patent: 12,234,346

Issued: February 25, 2025

Inventors: Sergio Corona Galván, Pedro José Pérez Romero, María del Mar Díaz Requejo and Álvaro Beltrán Martín

Assigned: Dynasol Elastomeros

Key statement: The present invention relates to a process for the functionalization of a rubber polymer comprising reacting the rubber polymer with at least one source of nitrene or carbene, in the presence of a catalyst of formula Tp^xAg , wherein Tp^x represents a hydrotris(pyrazolyl)borate ligand. This process leads to selective rubber functionalization without secondary reactions such as chain scission or crosslinking and produces functionalized rubbers with improved compatibilization properties. The invention also refers to the polymer produced therefrom and to uses of said polymer.

Reinforced rubber composition

U.S. patent: 12,240,979

Issued: March 4, 2025

Inventors: Li Jia and Yu Sun

Assigned: The University of Akron

Key statement: A curable rubber composition including a rubber, a plurality of ground particles and a reactive surfactant represented by the formula: $X-Y-Z$ where X is a reactive group capable of forming covalent links with the rubber during compounding or vulcanization, Y is a hydrophobic linkage and Z is a polar group capable of forming self-assemblies via intermolecular interactions and wherein the reactive surfactant is incompatible with the rubber and a method of making the same.

Aqueous silicone elastomers as roof coatings

U.S. patent: 12,240,992

Issued: March 4, 2025

Inventor: Timothy Krytenberg

Assigned: Industrial Control Development

Key statement: A method including coating a liquid aqueous silicone elastomer-containing composition onto a surface of a building roof substrate, wherein the building roof substrate is an ele-



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Patent News

ment of a standing building roofing system and then drying the liquid aqueous silicone elastomer-containing composition resulting in forming a topcoat on the building roof substrate.

Method for manufacturing nitrile based rubber, nitrile based rubber manufactured thereby and rubber composition comprising same rubber coatings

U.S. patent: 12,240,931

Issued: March 4, 2025

Inventors: Jae Min Lee, Byoung Yun Kim, Sung Min Son, Se Eun Lee and Woo Seok Choi

Assigned: LG Chem

Key statement: Provided are a preparation method of a nitrile based rubber, a nitrile based rubber prepared therefrom and a rubber composition including the nitrile based rubber and the nitrile based rubber has a low content of a residual emulsifier and excellent mechanical physical properties by using an emulsifier mixture including a first emulsifier including a sulfosuccinate ester based compound and a second emulsifier including a fatty acid or a metal salt thereof, or a rosin acid or a metal salt thereof, each of which has 12 to 18 carbon atoms and a monocarboxyl group, wherein the first emulsifier and the second emulsifier are included at a weight ratio of 2:1 to 6:1.

Mechanotropic elastomers

U.S. patent: 12,241,013

Issued: March 4, 2025

Inventors: Timothy White and Brian Richard Donovan

Assigned: The Regents of the University of Colorado, a Body Corporate

Key statement: Isotropic (amorphous) elastomers and methods of preparation are described. The isotropic elastomer may include a first monomer having an alkene functionality and a second monomer having a thiol functionality. The first monomer may be a liquid crystal monomer and the second monomer may be an isotropic monomer. Unlike polydomain LCEs, the isotropic elastomers may rapidly recover after deformation and have increased toughness relative to conventional elastomers prepared from wholly isotropic precursors.

Tires and wheels comprising adjustable stiffening lines and machines having same

U.S. patent: 12,240,278

Issued: March 4, 2025

Inventor: Erich Freytag



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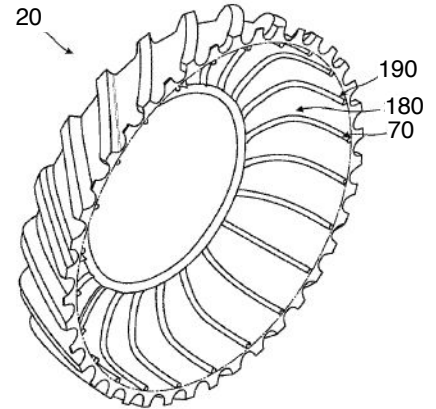
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Patent News

Assigned: AGCO International GmbH
Key statement: A tire has a carcass with a tread, a bead, a shoulder and a sidewall. The bead, shoulder and sidewall partially define a first internal cavity. At least one stiffening line for a pressur-

ized fluid with a second cavity is within the carcass. The second cavity is aligned in an approximately transverse direction relative to the periphery of the tire. The second cavity is connectable to pressurized fluid supply system and can

be inflated or deflated to adjust the stiffness of the tire. The stiffening lines may be inflated using a hydraulic fluid to increase the stiffness of the tire. Related wheels, vehicles and methods are also disclosed.



Method for producing a rubber-plastic composite


U.S. patent: 12,247,118

Issued: March 11, 2025

Inventors: Konstantin Efimov, Anna-Lena Dreier, Klaus Hülsmann, Andreas Pawlik, Marco Kormann and Maximilian Drexler

Assigned: Continental

Key statement: A method for producing a rubber-plastic composite, including the steps of (a) shaping an unvulcanized elastomer, (b) partially vulcanizing the shaped elastomer at a temperature of at least 140°C up to a degree of vulcanization in the range from 10% to 40%, (c) cooling the partially vulcanized elastomer to a temperature of less than 100°C within less than 20 minutes, (d) overmolding the partially vulcanized elastomer with a plastic and (e) heat treating the partially vulcanized elastomer overmolded with a plastic at a temperature in the range from 100°C to 170°C for a duration of from 5 minutes to 5 hours to complete the vulcanization and form a rubber-plastic composite. The method further relates to a rubber-plastic composite obtainable by the method according to the invention and also to a shoe comprising the rubber-plastic composite obtainable by the method according to the invention.




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Patent News

Tire cord, manufacturing method thereof and tire comprising same

U.S. patent: 12,252,816

Issued: March 18, 2025

Inventors: Sung Gyu Lee, Ok Hwa Jeon and Min-ho Lee

Assigned: Kolon Industries

Key statement: The present invention relates to a tire cord having excellent durability while being thin in thickness, a manufacturing method thereof and a tire comprising the same.

Tire tread rubber composition

U.S. patent: 12,251,965

Issued: March 18, 2025

Inventors: Anthony M. Unger, Adrian C. Stalnaker, Jessica L. Placke and Benjamin C. Galizio

Assigned: Bridgestone American Tire Operations

Key statement: Disclosed herein are tire tread rubber compositions comprising a specified elastomer component, reinforcing silica filler, a specified hydrocarbon resin, oil and a cure package. The elastomer component includes styrene-butadiene rubber; polybutadiene; and guayule natural rubber.

Method for the additive manufacturing of a silicone elastomer article

U.S. patent: 12,258,483

Issued: March 25, 2025

Inventors: Jean-Marc Frances, Marco Del Torto, Damien Djian, Emmanuel Pouget, Raphael Mirgalet and Remi Thiria

Assigned: Elkem

Key statement: The invention relates to a method for the additive manufacturing of a silicone elastomer article using a 3D printer. The invention also relates to a crosslinkable silicone composition for the additive manufacturing of a silicone elastomer article.

Processes for increasing the molecular weight of guayule natural rubber

U.S. patent: 12,258,427

Issued: March 25, 2025

Inventors: Robert W. White and Michael R. Hartzell

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Assigned: Bridgestone

Key statement: Disclosed herein are processes for increasing the molecular weight of guayule natural rubber that is solubilized in an organic solvent solution. The processes utilize shear desolventizing to achieve the increase in molecular weight.

Rubber compositions containing polyorganosiloxanes as plasticizers

U.S. patent: 12,258,450

Issued: March 25, 2025

Inventors: Volker Börger, Dörte Becker, Theresia Klose and Uwe Dittrich

Assigned: Schill + Seilacher Struktol GmbH

Key statement: The invention relates to rubber compositions that are provided with polyorganosiloxanes as plasticizers. The rubber compositions can be vulcanized by means of a crosslinking resin and they are particularly suitable for use as curing bladders in the pro-

duction of tires. The invention further relates to the use of polyorganosiloxanes as corresponding plasticizers.

Modified high-cis polybutadiene polymer, related methods and tire components

U.S. patent: 12,264,232

Issued: April 1, 2025

Inventors: Ryan J. Hue, Laura S. Kocsis, Terrence E. Hogan and Jeffrey A. Cicerchi

Assigned: Bridgestone American Tire Operations

Key statement: Disclosed herein are a process for preparing a modified high-cis polybutadiene polymer, a modified high-cis polybutadiene polymer and tires having a component made using the modified high-cis polybutadiene polymer. The processes make use of a functionalizing compound of formula (I) to prepare the modified high-cis polybutadiene from a quantity of

1,3-butadiene monomer using a specified catalyst system.

Rubber compositions for pneumatic tires

U.S. patent: 12,264,245

Issued: April 1, 2025

Inventor: Erin Sheepwash

Assigned: Bridgestone

Key statement: A vulcanizable rubber composition comprising (i) a rubber component including a polyisoprene elastomer, (ii) a sulfur based curative, (iii) zinc oxide and (iv) a eutectic composition.

Rubber composition for sealing material and sealing material using the same

U.S. patent: 12,264,236

Issued: April 1, 2025

Inventors: Akira Ueda, Sayaka Yoshida and Ryohei Nishihara

Assigned: Valqua

Key statement: Provided is a rubber composition for sealing material which contains 100 parts by mass of a rubber component, 50 to 140 parts by mass of silica, 1 to 20 parts by mass of a silane coupling agent and 15 to 35 parts by mass of carbon black. The rubber component is preferably an ethylene-propylene-diene rubber.

Rubber formulation

U.S. patent: 12,269,194

Issued: April 8, 2025

Inventors: Christopher Michael Twigg, Wim Migchels, Jeroen Claessens, Robert Jan Zootjes and Jan Gijsbertus Driessen

Assigned: Atlantis Rubber Powders

Key statement: A method for manufacturing micronized rubber powders including grinding of a rubber granulated feedstock, size classification and storage of the micronized rubber powders thus obtained. A rubber formulation including at least one natural or synthetic rubber, a micronized rubber composition and optionally one or more of processing aids, antidegradants, fillers, accelerators and curatives. A method for manufacturing a rubber product, as well as to a solid rubber product.

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The basics of short fiber reinforcement in elastomer and thermoplastic compounds

by Vishhhhal K. Chaurasia, David Maroli and Steve Trapp, Finite Fiber

Short fiber reinforcement has long been utilized in elastomeric and thermoplastic compounds to enhance properties, yet the underlying science remains frequently misunderstood. This article provides an overview of the science behind fibers in various compounds, comparing the individual fiber material types. These include cotton, cellulose, polyester, nylon, aramid and carbon fiber.

The forms of fiber, including monofilament, pulp, flock, micronized and bundles, will be discussed, along with the effect of their geometry (length, diameter and surface area). In order to obtain optimal properties with fiber, the mixing and manufacturing process of the fiber with elastomeric or thermoplastic compounds is critical. Best practices for these processes will be presented. Finally, adjustments to the compound in order to incorporate the fiber will be discussed. The impact of the key material physical properties such as tensile modulus, elongation, ultimate tensile, tear strength and abrasion resistance will be shown, as they relate to the factors above.

Short cut fiber forms

The terminology and options around cut fibers can be very confusing. Does one need flock, precision cut, random cut, micronized, pulp, dry milled, wet milled, fibrillated, staple or cord? Many of these terms are interchangeable; and in many cases, lack standardized definitions.

The distinction between precision cut and random cut primarily pertains to the uniformity of fiber length. Precision cut fibers exhibit minimal variation in length; whereas random cut fibers display a broader distribution. Flock (figure 1) refers to short cut fibers typically measuring 6 mm or less, although no universally accepted cutoff length exists. It often has a powder-like appearance.

Micronized is another version of flock, but is always less than 1 mm in length. Dry milled refers to the cutting method for a random cut flock. This process inherently has a high variability in fiber cut length. In contrast, precision cut flock is processed on an indexing guillotine style cutter.

Staple fibers (figure 2) are usually greater than 6 mm, and typically precision cut.

A pulp (figure 3) is a type of fiber with branched morphology. The length of the fiber is usually less than 6 mm. The branching promotes improved mechanical bonding with the polymer

Figure 2 - staple fibers are typically longer than 6 mm



Figure 1 - flock is a short cut fiber, usually less than 6 mm



Figure 3 - pulp fibers have prominent fibrillation

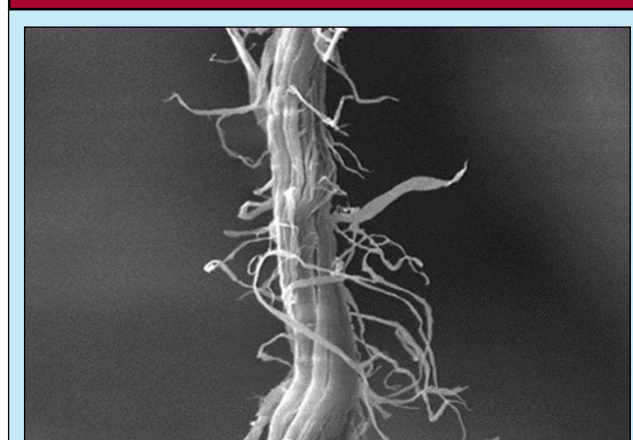


Figure 4 - fiber cord is a constructed fiber bundle



matrix, contributing to enhanced reinforcement. These fibers are sometimes called fibrillated fibers. They can be produced on a wet milling process where the liquid softens the fiber to allow for a mechanical creation of the branches.

A fiber cord is a constructed fiber bundle (figure 4) with hundreds of individual fibers. The cord can be precision cut to the desired length and subsequently added to a rubber matrix. The shear force of mixing in an internal mixer breaks up the bundle into individual fibers for reinforcement.

Fiber specifications

Depending on the supplier and/or type of fiber, the fiber specifications may differ. Fiber length is typically specified by a nominal value, along with a range and the percentage of fibers falling within that range. For shorter fibers, such as flock, length may be determined using a sieve test which reports the percentage of fibers passing through a specific mesh size. While this method is convenient, it lacks the precision of microscopic measurement techniques.

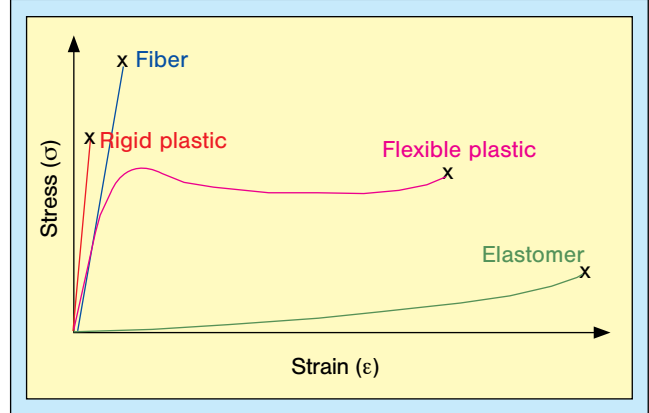
The fiber diameter is specified two different ways: as a direct measurement in microns, or using denier. Denier is a legacy textile unit of measure defined as the mass (in grams) of 9,000 meters of filament. The SI equivalent is dtex, which is 0.9 x denier. To convert denier to diameter, the material's density must be known, using the following equation:

$$\text{Diameter (microns)} = 11.89 * \sqrt{\frac{\text{Denier}}{\text{Density} \left(\frac{\text{g}}{\text{cm}^3} \right)}}$$

In pulps, the specific surface area is sometimes included in the specification. This is the total surface area of a material per unit mass. The SI unit is m²/gram. In a pulp, this defines the amount of fiber fibrillation or branching.

Moisture content is another attribute that is included in specifications. Excessive moisture can lead to processing challenges.

Figure 5 - relative stress versus strain relationship for various polymers



Fiber materials

The utilization of natural fibers as a reinforcement in elastomer compounds has been around for nearly a century, and continues to find application in specific formulations. These materials include cotton, cellulose, flax, kenaf, jute, wool, hemp and coconut, just to name a few. Natural fibers offer unique advantages, particularly in the context of sustainability. These renewable materials are biodegradable, often sourced from agricultural byproducts, and can contribute to reducing the environmental footprint of rubber products. Their use aligns with growing industry efforts to develop more sustainable and eco-conscious formulations.

However, today's fiber additives in rubber are dominated by synthetic materials such as polyester, nylon, aramid and carbon. A relative comparison of some of the most popular fibers for rubber compounds is shown in table 1.

Physical property enhancement

The primary objective of fiber reinforcement in elastomeric and thermoplastic compounds is to enhance fundamental physical properties, thereby optimizing performance for specific applications. Key properties that can be tailored through fiber addition include tensile modulus, elongation, ultimate tensile strength, tear resistance, abrasion resistance, green strength, coefficient of friction and thermal resistance. The key factors influencing these properties include fiber material, fiber length, specific surface area and fiber loading.

The effect of fiber on the stress strain relationship of the rubber compound is probably the most studied. In figure 5, the relative stress versus strain relationship is shown for various polymers. Rigid plastics and fibers are much stiffer in the low strain region. Flexible plastics provide moderate stiffness initially, but tend to plateau at higher strain levels. In contrast, elastomers display a relatively constant slope throughout the elongation range, indicating low stiffness and high extensibility.

When fiber is added to an elastomer compound, a composite material is created. It creates a stress strain curve that is a combination of the fiber and elastomer curve from above. In figure 6, the stress versus strain curve of 6 phr of Varamix aramid fiber in an EPDM compound is compared to a control EPDM com-

Table 1 - comparative overview of commonly utilized fiber types

Property	Aramid	Pan carbon	Nylon	Polyester	Cotton	Cellulose
Density	Medium	High	Low	Medium	Medium	Medium
Tensile strength	High	High	Medium	Medium	Low	Low
Modulus	High	High	Medium	Medium	Low	Medium
Elongation at break	Low	Low	High	Medium	Medium	Low
Tear strength	High	High	Medium	Medium	Low	Low
Abrasion resistance	High	Low	Medium	Medium	Low	Low
Moisture content	Medium	Low	Medium	Low	Medium	Medium
Melting or decomposition temperature	High	High	Medium	Medium	Low	Medium
Conductive	No	Yes	No	No	No	No

pond. The key observation is the significant increase in modulus at low elongation levels, indicated by the steeper initial slope of the curve. This region reflects the reinforcing effect of the fiber. The initial peak defines a yield point for the compound. This is where the interfacial bond between the fiber and rubber matrix starts to destruct. The curve then transitions back to rubber-like behavior. In a fiber loaded compound, the operating conditions should remain below the yield point.

The bar graph in figure 7 shows how the modulus of an aramid fiber loaded EPDM compound at 3 phr and 6 phr changes as elongation increases. Notably, at 20% elongation, the compound with 6 phr fiber loading exhibits nearly a threefold increase in modulus relative to the control, demonstrating the significant reinforcement effect in the low strain region. However, as elongation increases, the modulus enhancement diminishes, with values converging near 200% elongation. This behavior reflects the limited contribution of fiber reinforcement at higher strain levels, where the elastomer matrix dominates the mechanical response.

Another important aspect to consider when adding fiber is anisotropy. This is defined as having a physical property that has a different value when measured in different directions. In fiber reinforced systems, stiffness is significantly greater along the direction of fiber orientation compared to the cross-fiber direc-

tion. If there is no orientation, this is known as random orientation. The degree of anisotropy is quantified by the anisotropic ratio, defined as the modulus in the with-grain (fiber aligned) direction divided by the modulus in the cross-grain direction. From the graph in figure 8, as the fiber length increases, the anisotropic ratio increases.

Figure 7 - tensile modulus with Varamix (V7030) in EPDM

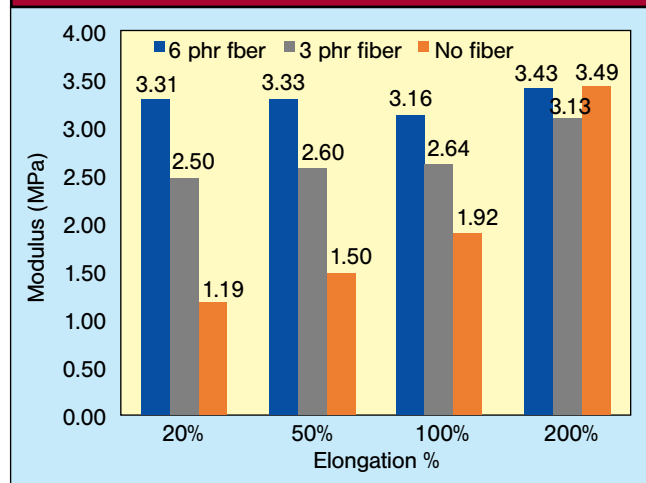


Figure 6 - EPDM compound with and without fiber

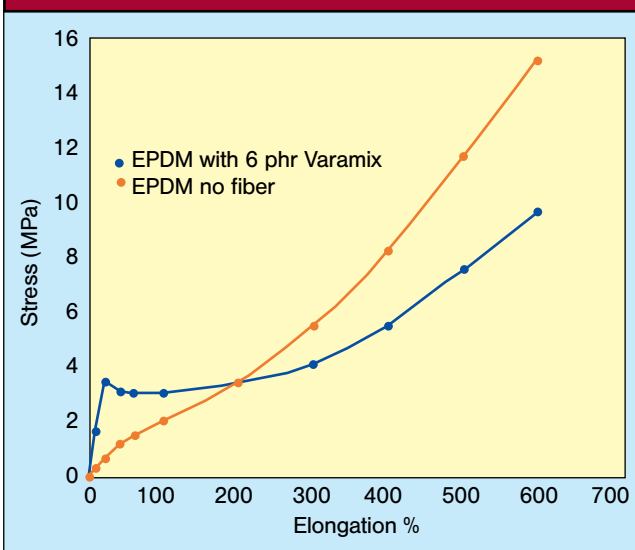


Figure 8 - anisotropic ratio for nylon fiber in EPDM (with grain modulus)/(cross grain modulus)

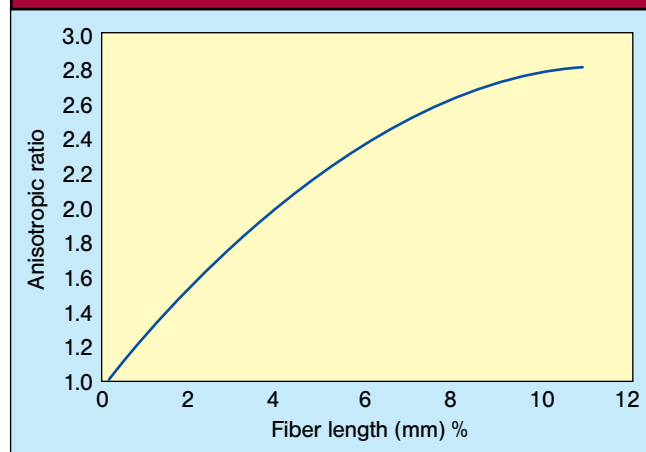
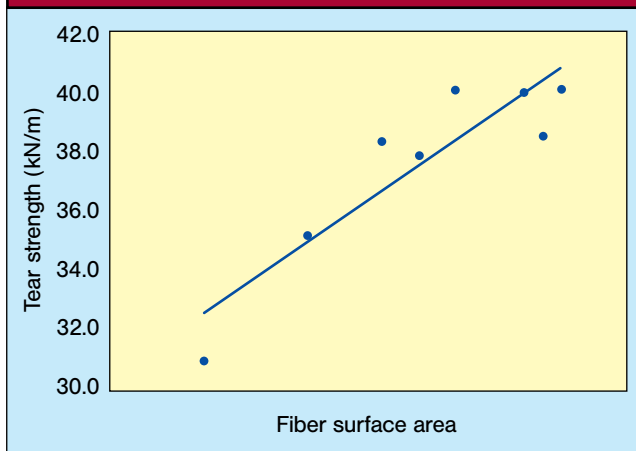


Figure 9 - tear strength versus surface area, aramid pulp in EPDM



Adding fiber typically decreases the ultimate tensile strength and elongation of an elastomer compound. This at times can be a point of contention, since it is often believed to be the most important measure of strength. The ultimate tensile and elongation tests are still very common and put into specifications; but, as stated in the book, *Rubber Technology*, Second Edition, “High tensile strength is seldom required in service and, by itself, does not guarantee the level of any other property.” Therefore, compound design should prioritize properties aligned with the intended application, rather than relying solely on ultimate tensile and elongation values. These tests are more appropriately used for quality control purposes, ensuring consistency in polymer compounding, rather than serving as definitive design criteria.

The tear strength of an elastomer compound can also be improved by adding fiber. The graph in figure 9 shows the tear strength and how it relates to aramid pulp surface area. As the surface area is increased, the tear strength of the compound increases.

Both abrasion and wear resistance can be increased with fiber addition. However, the improvement is hard to quantify in laboratory tests such as DIN and Taber abrasion testing. This is due to the fiber orientation during sample preparation. In order to improve abrasion, the fibers must be oriented perpendicular to the surface of the test specimen. This is difficult to accomplish when compression molding test samples. As a result, laboratory based measurements may not fully capture the performance benefits of fiber reinforcement. Final part testing under actual service conditions provides a more accurate assessment of abrasion and wear improvements resulting from fiber addition.

Mixing of short cut fiber loaded compounds

Probably the number one issue seen when adding fiber to an elastomer compound is inadequate fiber dispersion. It is recommended to add the fiber in the internal mixing step early, typically when other filler is added. A minimum of two passes is almost always required. Some hard-to-disperse fibers may need additional passes.

A typical mixing sequence for an internal mixer involves adding approximately half of the fiber and half of the reinforcing

filler about 30 seconds after the polymer. Mix for one minute, then add the other remaining half of the fiber and half of the filler. This can vary, depending on the compound, and the fiber supplier can be consulted.

Incorporating fiber also necessitates adjustments to the compound formulation. Most notably, the level of reinforcing filler must be reduced to maintain target hardness. A general guideline suggests removing 1.5 to 4 phr of filler for every 1 phr of fiber added; though the exact ratio depends on the filler type. Fiber suppliers can provide tailored guidance based on the specific materials used.

To further improve dispersion, additional ingredients such as process oils, process aids or low molecular weight polymers may be included. Bonding aids may also be added to the compound or pre-applied to the fiber to enhance polymer-fiber interfacial adhesion. Common bonding agents include resorcinol formaldehyde latex (RFL), silanes and hexamethoxymethylmelamine (HMMM), among many others. A more detailed exploration of these additives may be presented in future publications.

Summary

Why reconsider the use of fiber reinforcement, given its nearly century-long history in elastomer compounding? The answer lies in the evolution of fiber technology. Today’s fiber additives are available in a broad spectrum of chemical compositions, including organic, synthetic, aramid, carbon, and coated or uncoated variants, as well as diverse physical forms, such as varying diameters, bundle configurations, twists, fibrillation levels and lengths. These advancements enable tailored compound properties, including enhanced tensile strength, modulus, abrasion resistance, tear strength, noise reduction, thermal stability and cut resistance.

In recent years, sustainability has emerged as a priority within the polymer industry, shaping decisions around material sourcing, formulation and manufacturing practices. The use of natural and synthetic fibers, especially those that are recycled, reused or repurposed, offers a viable path toward more environmentally responsible compound design. As highlighted in *Rubber World*, efforts to make elastomer products more environmentally friendly have intensified across companies of all sizes, with increasing emphasis on sustainable additives and circular material strategies. Even within the thermoplastics sector, similar trends are evident. For example, NPE 2024, organized by the Plastics Industry Association, identified sustainability as its top priority. As a result, sustainable sourcing options for both synthetic and natural fiber additives are now widely available.

Short cut fibers incorporated into elastomer and thermoplastic compounds can deliver significant benefits in terms of physical performance and environmental responsibility. To fully realize these advantages, it is essential to collaborate closely with a fiber supplier to select the appropriate fiber type and form for an application. Proper compound adjustments and optimized mixing procedures are critical to success. Finite Fiber’s technical team, as well as other additive suppliers, can assist in identifying suitable fiber specifications, recommending formulation modifications and advising on production changes to ensure the compound achieves its highest potential performance.

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Lignin-soy based flexible polyurethane foam for automotive applications

by Enoch Kofi Acquah, Rafael Auras, Anibal Bher, Kevin Dunne and Mojgan Nejad, Michigan State University

Polyurethane (PU) flexible foams are utilized across various industries, including automotive seating, furniture, packaging, medical devices, sporting goods, sound absorption and apparel, offering comfort, durability and performance benefits in each application. Polyurethane is produced from a step-growth polymerization reaction between polyol and isocyanate. This reaction occurs with or without a catalyst. The polyol part forms the soft segment, whereas isocyanate forms the hard segment. Based on this, the properties of the final PU product can be tailored towards the target performance or end use by varying the properties of components. The performance of polyurethane foam depends on the hydroxyl value, functionality and molecular weight of polyol, as well as isocyanate type (ref. 1). In formulating foams, a blowing agent such as water is added to react with isocyanate, thus generating carbon dioxide gas to expand the polymer matrix.

Polyester and polyether polyols are primarily used for polyurethane synthesis, with the latter being mostly used in flexible foam formulation due to its resistance to hydrolysis. Conventional polyether polyols are produced from the ring opening polymerization of alkylene oxide in the presence of a basic catalyst and an initiator such as ethylene glycol, propylene glycol, sorbitol or glycerol, based on the target functionality (ref. 2). Generally, low hydroxyl value, high molecular weight and low functionality (typically 2-3) polyols produce flexible and less crosslinked polymers, whereas high hydroxyl value, low molecular weight and high functionality polyols yield rigid and highly crosslinked polymers (ref. 1). Viscosity is another crucial physical characteristic of all polyols, as it influences the processability of the resin, which subsequently impacts the quality of the foam generated. Polyol viscosities typically below 15,000 cP at 25°C are generally preferred. Despite the various applications of polyurethane flexible foams, the major drawback has been the source of feedstocks or raw materials. Currently, many PU flexible foam polyols are fossil based, utilizing toxic alkylene oxides such as propylene oxide. Additionally, the constant fluctuation of crude oil prices has also been a cause for concern. This has motivated researchers to explore various sustainable alternatives to replace these petrochemicals.

Over the years, researchers have attempted to partially replace petroleum based polyols with bio-based alternatives, such as castor oil, soyabean oil (refs. 3-12), and palm oil (refs. 13 and 14). Castor oil has been employed directly to produce PU foams due to the presence of hydroxyl groups in their fatty acid backbone (ref. 15). Vegetable oils have also been heavily studied by researchers and industries to produce bio-based polyols via various modification methods, with epoxidation and ring opening being already employed by industries on soyabean oil. In this process, double bonds on the triglyceride chain are epoxi-

dized in the presence of acetic/formic acid and hydrogen peroxide to yield hydroxyl groups useful for PU applications (ref. 16). This has led to the commercialization of soy based polyols by many companies, such as Cargill.

Lignin, despite being the second most abundant natural polymer after cellulose, has received minimal attention in PU flexible foams. Lignin is a complex natural polymer that accounts for about 30 wt.% of biomasses on a dry mass basis. It is a by-product of the pulp and paper industry, and biorefineries. Chemically, lignin is a multi-functional polymer made up of aliphatic, phenolic and carboxylic hydroxyl groups, making it a good candidate as a polyol replacement in polyurethane foam formulation (ref. 17). Despite its potential, it is primarily combusted to generate energy in industry, making it an underutilized resource of biomass.

Lignin can be an excellent precursor, typically as a polyol, for use in polyurethane synthesis due to the presence of unique hydroxyl functionalities. Lignin incorporation into various polyurethane products has been demonstrated in most cases to provide excellent performance benefits, such as increasing the bio-based content of the polyurethane, increased ultraviolet (UV) stability (ref. 18), antioxidant properties (ref. 18), flame retardancy (refs. 19-21), mechanical strength and thermal stability (refs. 22 and 23). Research on the utilization of lignin in flexible PU foams has been relatively limited. Over the past decade, only 16 papers have been published on the subject (refs. 24-39), compared to the extensive research conducted on its application in rigid foams. Despite lignin's potential to enhance mechanical strength in materials, its high hydroxyl value and functionality (refs. 40-42), glass transition temperature and crosslinked structure (refs. 22, 42 and 43) can reduce the flexibility, resilience and ultimate elongation of flexible PU foams, limiting lignin incorporation into flexible foams. Another significant challenge is lignin's three-dimensional structure, which makes it less accessible for reaction with isocyanate (ref. 44). Additionally, lignin's solid nature and poor solubility (ref. 45) in co-polyol prevent it from functioning as a "true" polyol within the PU polymer matrix, instead acting as a filler that contributes to the rigidity of flexible foams. Therefore, overcoming these challenges is essential for harnessing lignin's potential as a sustainable polyol in polyurethane flexible foam formulations.

Hence, this project aims to develop a novel process for synthesizing liquid lignin polyols with low hydroxyl values and workable viscosities that can be used directly to produce flexible PU foams for automotive seating applications.

Experimental

Lignin characterization

The acid hydrolysis hardwood lignin sample was characterized completely for its hydroxyl content, thermal properties, elemental composition and molecular weight distribution. The hydroxyl content of lignin was determined using ³¹P-NMR

Table 1 - variable components of flexible foam formulation

Sample ID	Lignin polyol (pphp)	Soy-polyol (pphp)	Polyether co-polyol (pphp)
Control	0	0	100
LP 10	10	0	90
LP 20	20	0	80
LP 30	30	0	70
LP 40	40	0	60
SP 10	0	10	90
SP 20	0	20	80
LP 20-SP 20	20	20	60
LP 30-SP 30	30	30	60

Table 2 - constant components of polyurethane foam formulation

Component	pphp
Blowing agent	3
Gelation catalyst	0.65
Blowing catalyst	0.32
Silicone surfactant	1.5

boxylic acids (125.9-134.0 ppm). Thermal properties were measured using differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). Elemental analysis was performed using inductive-coupled plasma atomic emission spectroscopy (ICP-AES) to determine lignin's compositional elements. The molecular weight was measured using gel permeation chromatography (GPC) by analyzing acetylated lignin. Acetylation was done to enhance lignin's solubility in tetrahydrofuran (THF).

Polyol synthesis

Oven dried acid hydrolysis hardwood lignin was modified using a novel synthesis process (Michigan State University [MSU] patented technology) to obtain lignin polyol. This process employs a safe reactive liquefying agent to produce polyol that is liquid at room temperature and can be used directly in the formulation of flexible foams. Lignin polyol with different hydroxyl values and viscosities was synthesized, characterized and incorporated in flexible PU foam by replacing a portion of the conventional petroleum based polyol.

Polyol characterization

Hydroxyl value

The hydroxy contents of the polyol were measured using ³¹P-NMR spectroscopy using a method like that used for lignin characterization. The hydroxyl value (OHV), measured in mg KOH/g, of the polyol was computed by multiplying the total hydroxyl content (mmol/g) by 56.1.

Viscosity

The lignin polyols' viscosity was assessed at ambient temperature employing a rheometer. A 40 mm stainless steel plate geom-

etry with a 1 mm gap was utilized, with samples sandwiched between the plates and trimmed before analysis. Viscosity measurements were conducted under a constant shear rate of 50 s⁻¹, with the recorded viscosity representing the average value over 60 seconds.

Foam formulation

Foams were prepared according to the formulation in tables 1 and 2. Foams with varying amounts of lignin polyol were formulated for characterization. 10, 20, 30 and 40 pphp of the petroleum based polyols were replaced with the lignin polyol to synthesize flexible polyurethane foams. Foams containing both lignin and soy polyols were also synthesized to increase the bio-based carbon content. Isocyanate index was set at 100 for all foams.

In a 12 ounce paper cup, 100 g of polyol blend, catalysts and surfactants were mixed at 3,000 rpm using a high speed mixer for two minutes. Finally, the calculated amount of isocyanate was added using a disposable plastic syringe and mixed at 3,000 rpm for 3-5 seconds.

The mixture was then quickly poured into an 8" x 8" x 3" silicone mold conditioned at 65°C and left to cure at room temperature for about 30 minutes before demolding. After demolding, it was left to post-cure for two days at room temperature. Samples were cut into mechanical testing specimens devoid of skin.

Mechanical property testing

The foam samples were cut into mechanical testing specimens, as illustrated in figure 1, without any skin present. These samples were then subjected to property characterization using an Instron universal testing machine based on the ASTM D3574 test standard (ref. 46) to assess their physical and mechanical properties, including density, compression force deflection (CFD), support factor, tensile strength, ultimate elongation at break, tear strength, compression set and hysteresis loss. The obtained values were then compared to the standard requirements for automotive seating applications.

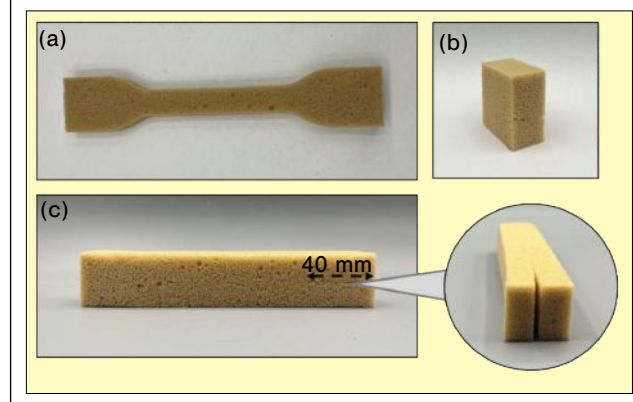
Figure 1 - mechanical property testing specimen geometry for (a) tensile and elongation at break, (b) compressive force deflection and (c) tear strength

Figure 2 - formulated flexible PU foams produced from synthesized lignin polyol

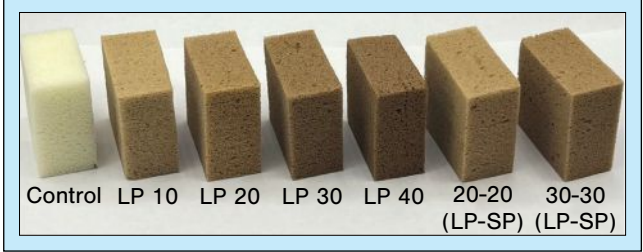


Table 3 - properties of synthesized lignin polyols

Entry number	Polyol ID	Hydroxyl value (mg KOH/g)	Lignin content (%)	Viscosity (Pa.s)
1	Ligol 1	179	39 ± 2.1	11.66 ± 0.45
2	Ligol 2	151	35 ± 1.8	16.88 ± 0.75
3	Ligol 3	111	38 ± 2.0	25.95 ± 0.93

Results and discussion

Polyol properties

Table 3 shows the properties of synthesized lignin polyol. Three polyols with different properties were produced by varying reaction parameters. The hydroxyl value of the synthesized lignin polyols ranges from 111 to 179 mg KOH/g, making them suitable to be used in the formulation of flexible foams.

Foam properties

Mechanical properties

A comparative study took place on the effect of lignin polyol on flexible PU foam properties by formulating foams, with compositions in table 1, using Ligol 1 polyol (179 mg KOH/g) (figure 2). Foam mechanical properties, presented in figures 3 and 4, were measured according to the ASTM D3574 standard testing method and compared to the standard requirement for automotive seating applications (red border lines). The properties of the foam are strongly dependent on its density. Thus, the densities

Figure 3 - mechanical properties of synthesized polyurethane foams as measured by ASTM D3574: (a) density, (b) compression force deflection, (c) support factor and (d) hysteresis loss

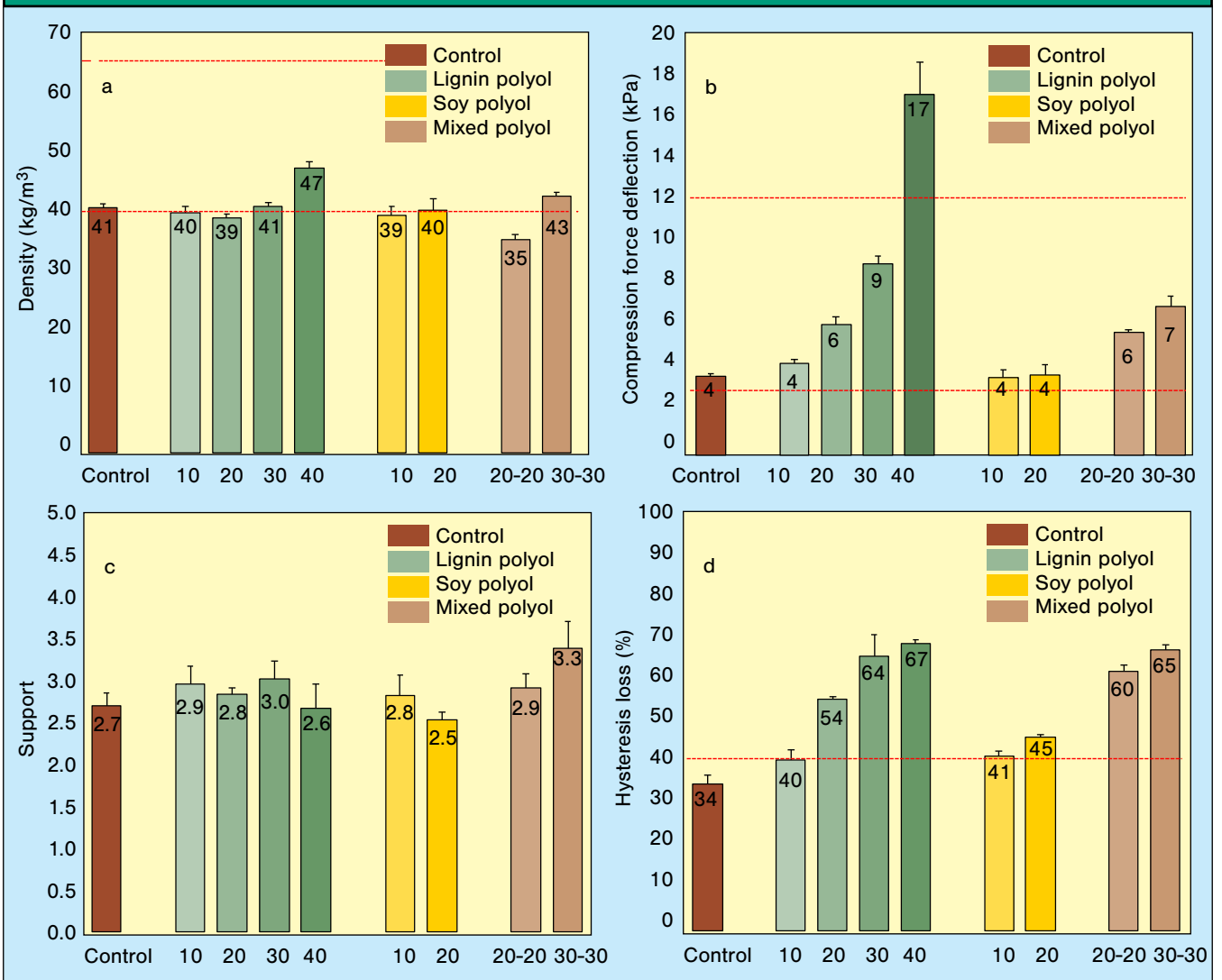
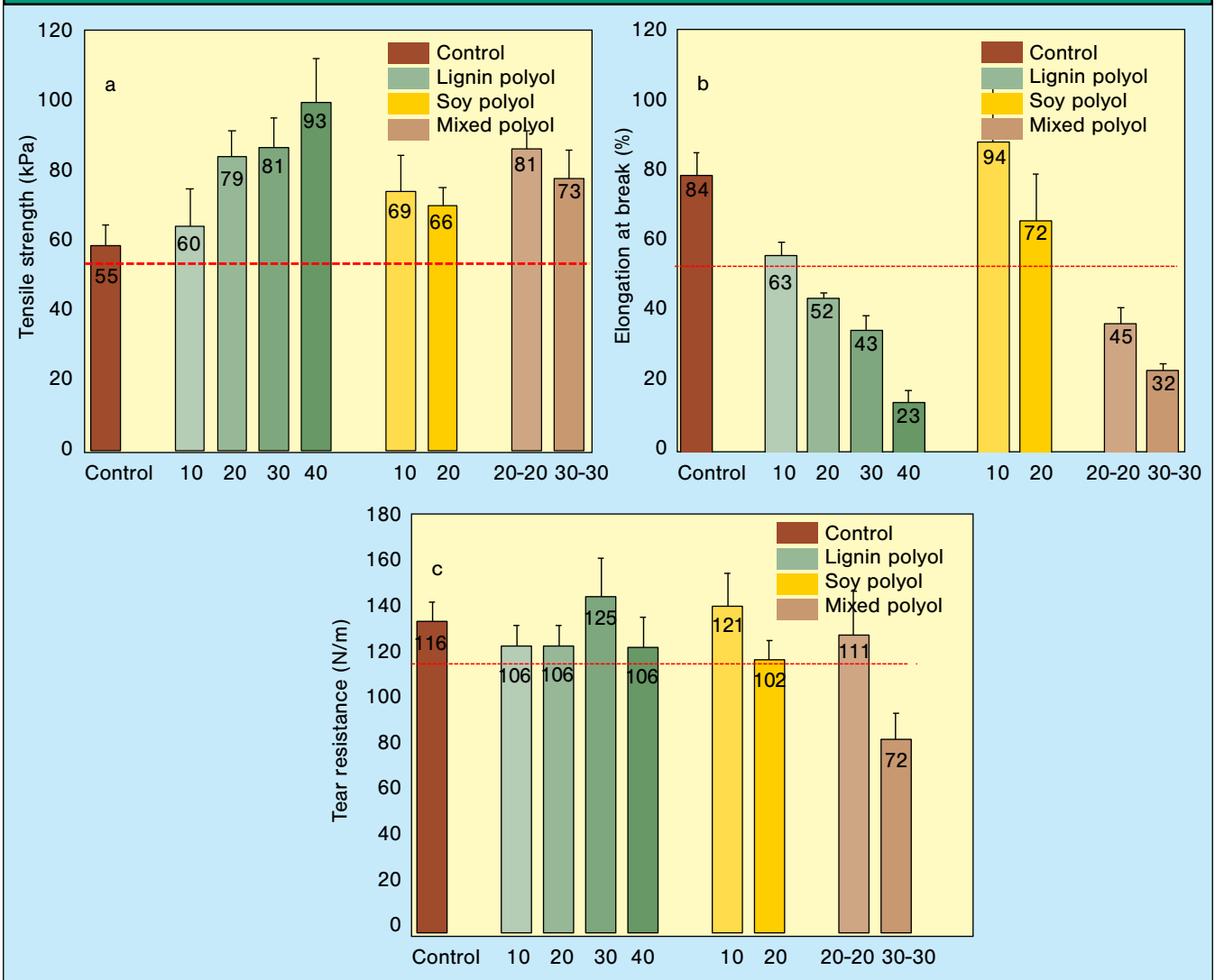


Figure 4 - mechanical properties of synthesized polyurethane foams as measured by ASTM D3574 Tests E and F: (a) tensile strength, (b) ultimate elongation and (c) tear strength



of foam should be similar to effectively compare their properties. As the lignin content in the foams increased from 10% to 40%, there was a noticeable increase in the density values, with the foams containing 40% lignin polyol exhibiting the highest density. This result can be attributed to the higher concentration of lignin polyol in the polyol blend, which consequently necessitates a larger amount of isocyanate to react owing to its high hydroxyl value, thus resulting in a foam with a higher density. The densities of all foam samples fell within the range of 35 to 65 kg/m³.

The compressive force deflection, indicating the foam's resistance to deformation under load, varied with the type and percentage of polyol used. Lignin based foams generally exhibited higher compressive force deflection values compared to soy based foams, particularly as the lignin content increased. This suggests that lignin imparts greater rigidity and load bearing capacity to the foams owing to its aromatic structure. The mixed polyol foam's CFD value reflected a balance between the rigidity provided by lignin and the flexibility contributed by soy

polyol. The support factor, which is an indication of foam's cushioning performance, was between 2.5 to 3.3, thus making it suitable for use in automotive seating applications.

Tensile strength, a measure of the foam's ability to withstand tension, showed variations depending on the polyol content. Foams with higher lignin content demonstrated higher tensile strength due to the robust aromatic structure of lignin and the relatively high hydroxyl value of lignin polyol. In contrast, soy polyol foams exhibited slightly lower tensile strength, with the mixed polyol foam displaying moderate tensile strength. This intermediate value underscores the synergistic effect of combining lignin and soy polyols. Elongation at break, representing the foam's flexibility, also varied with polyol composition. Lignin based foams exhibited lower elongation at break values due to their inherent rigidity. Soy polyol, due to its relatively low hydroxyl value and functionality, produced foams with higher strain values. However, the mixed polyol foams exhibited very low elongation at break values. This outcome could be attributed to the high functionality and hydroxyl value of lignin, which

Table 4 - effect of lignin polyol hydroxyl values on flexible polyurethane foam properties (30% polyol substitution) according to ASTM D3574 standards

Mechanical property	Desired range	Unit	Lignin polyol foam properties (30 part)		
			Ligol 1	Ligol 2	Ligol 3
Density	40-65	kg/m ³	41 ± 0.5	47 ± 0.4	49 ± 0.2
Tear strength	100	N/m	125 ± 14	112 ± 9	113 ± 14
Compression force deflection (CFD)	3-12	kPa	9 ± 0.3	8 ± 0.4	6 ± 0.1
Support factor	-	-	3 ± 0.2	4 ± 0.2	5 ± 1.0
Tensile strength	50	kPa	81 ± 8.0	89 ± 8.7	71 ± 3.0
Elongation	60	% strain	43 ± 3.9	45 ± 4.6	41 ± 2.0
Hysteresis loss	-	%	64 ± 4.9	53 ± 1.0	53 ± 2.0

Table 5 - thermal properties of foams

Sample	Weight loss at 150°C (%)	T _{onset} (°C)	T _{10%} (°C)	T _{max} (°C)		Residue weight %
				Stage 1	Stage 2	
Control	0.30	343	306	316	379	9.74
LP 20	0.93	323	289	307	371	13.18
LP 30	1.03	304	286	310	363	15.26
LP 40	2.31	276	274	307	354	12.00
Lp 30 SP 30	1.26	309	281	296	377	13.74

increased foam's crosslinking density.

Tear strength, indicative of the foam's resistance to propagating cracks, was also found to be influenced by the polyol type and concentration. Tear strength of lignin polyol foams improved as lignin content increases up to 30%, after which it dropped significantly. The dip in property was unexpected, as lignin typically improves tear strength due its crosslinked nature. The decrease in tear values after 40% lignin incorporation could be a result of the increased unreacted liquefying agent concentration in the final foam. In contrast, soy polyol foams showed a decreasing tear strength value as soy content increases. The mixed polyol foam's tear strength showed an intermediate value; however higher soy content significantly reduced tear strength.

Hysteresis loss, which relates to energy dissipation during cyclic loading, varies with foam composition. Foams with higher lignin polyol content exhibited greater hysteresis loss, and thus lower resilience. This is due to the high rigidity provided by the aromatic structure of lignin and the relatively high hydroxyl value of lignin polyol. Increasing levels of unreacted liquefying agent could also contribute to the reduction in foam resilience, although more research is needed to confirm this hypothesis. Conversely, soy polyol foams demonstrated lower hysteresis loss due to the flexible structure of the fatty acid backbone and the low hydroxyl value of soy polyols. The mixed polyol foams exhibited poor resilience, potentially due to unreacted propylene carbonate from the lignin polyol. The high energy dissipation rate of lignin polyol based foams could be beneficial for sound absorption applications. This comparative analysis provides valuable insights for optimizing foam formulations for specific applications, balancing rigidity, flexibility, strength and energy dissipation.

Different synthesized lignin polyols, each with varying hydroxyl values, were assessed by formulating foams containing

30% lignin polyols to examine their impact on foam mechanical properties. As shown in table 4, there was a slight decrease in tear strength and compression force deflection as the hydroxyl values decreased, although it remained within the standard requirement for seating applications. Moreover, it was generally noted that low hydroxyl value lignin polyols led to an increase in the support factor, an empirical measure related to the compression modulus and widely utilized in the industry to gauge foam cushioning. For example, foams with higher support factors are less prone to "sinking in" when subjected to prolonged stress (ref. 47). Consequently, low hydroxyl value ligols can play a crucial role in enhancing foam load bearing performance in seating applications. There was no significant improvement in tensile strength and ultimate elongation as the hydroxyl value reduced from 179 to 151 mg KOH/g, but a decrease in tensile strength was observed when Ligol 3 (111 mg KOH/g) was used. This outcome was expected, since low hydroxyl value polyols typically result in reduced crosslinking density, thereby decreasing the foam's tensile strength. Interestingly, foam's strain at break remained the same. This could be a result of the high functionality of lignin, which may have affected foam's flexibility. Notably, there was a significant reduction in hysteresis loss, with decreasing lignin polyol hydroxyl value indicating a potential enhancement in foam resilience, which is pertinent for seating applications.

Thermal properties

Figures 5 and 6 display the weight-temperature (a) and differential weight-temperature (b) curves of the foams. Both control and lignin polyol based foams exhibit similar thermal weight loss characteristics. All foams showed a minor weight loss at temperatures below 150°C, peaking around 105°C, likely due to small molecule evaporation. As lignin polyol content increases, the percentage of weight loss from small molecule evaporation

Figure 5 - thermogravimetric analysis (TGA) thermogram (a) and derivative peaks (b) of foams synthesized with 20, 30 and 40 pphp lignin polyols

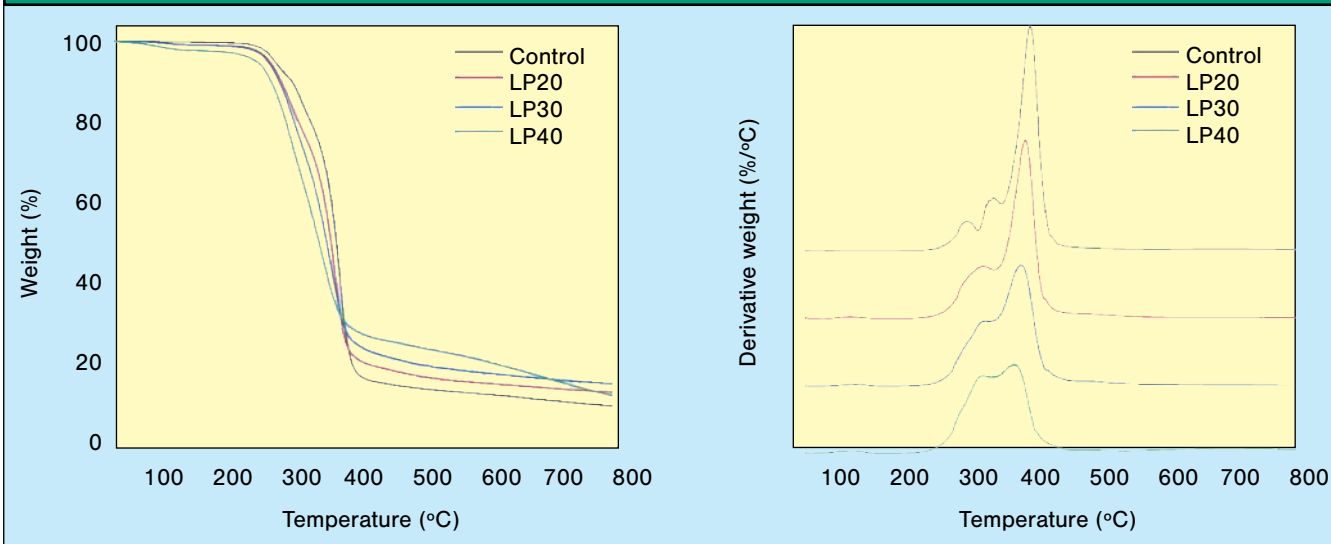
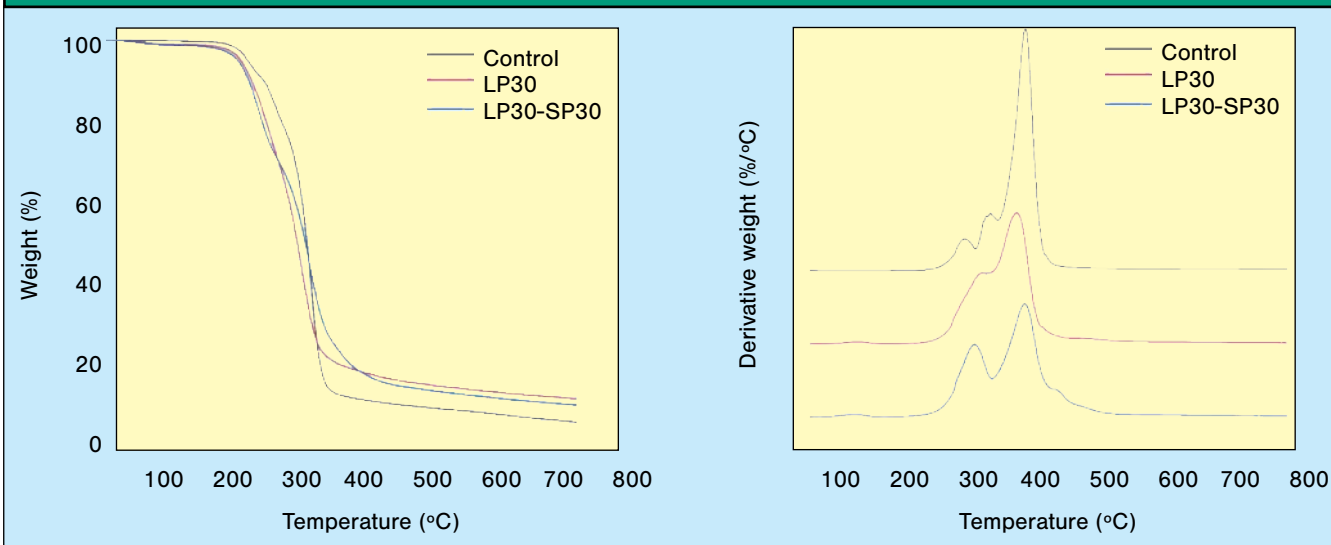


Figure 6 - thermogravimetric analysis (TGA) thermogram (a) and derivative peaks (b) of foams synthesized with 30 pphp lignin polyols with and without 30 pphp soy polyol



risers, with LP 40 showing the highest weight change at 2.31%. In the first thermal degradation phase (296°C to 315°C), weight loss is due to the irreversible degradation of hard segments and urethane bond breakage, resulting in the formation of amines, olefins and CO₂ (ref. 48). The subsequent weight loss between 354°C and 379°C is linked to soft segment degradation (refs. 22 and 49). The soft segment degradation temperature (T_{max}) decreases with increasing lignin polyol, as seen in table 5. The temperature at onset (T_{onset}) and the temperature at 10% degradation ($T_{10\%}$) also decrease with higher lignin polyol content. In the derivative weight change curve (figure 5b), the incorporation of lignin polyol significantly reduced the degradation rate of foams, enhancing their thermal stability. This stability is attributed to the complex aromatic structure of lignin. With increasing lignin polyol substitution, the residue content of foams at 800°C

initially increased (from 9.74 to 15.26%), but later declined at 40% incorporation.

Conclusion

This study demonstrates the feasibility of synthesizing and incorporating novel lignin based polyols, alongside soy- based polyols, into flexible polyurethane foams for automotive seating applications. The synthesized lignin polyols exhibited suitable hydroxyl values ranging from 111 to 179 mg KOH/g and viscosities for foam formulation, and the resulting foams showed improved tensile strength, support factor and compression force deflection. Thermogravimetric analysis (TGA) demonstrated that the incorporation of lignin polyol decreased the rate of foam thermal degradation. This research serves as the first step in developing a novel process in producing lignin polyols with

tunable properties. Future work will focus on optimizing the synthesis process to obtain polyols with hydroxyl value less than 100 mg KOH/g and workable viscosities, and ensuring that formulated foams meet all standard requirements for seating application.

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Example: Reconstructed Formulation

INGREDIENT	PHR	EXTRACT.	ASH	VOLUME
Polyisoprene Rubber	80.0	0.8		86.0
Styrene-Butadiene Rubber	20.0	0.2		21.3
Carbon Black (N300 Series)	44.8			24.9
Silicon Dioxide	15.2		14.6	7.6
Zinc Oxide	3.0		3.0	0.5
Hydrocarbon Oil	7.2	7.2		8.0
Stearic Acid	1.0	1.0		1.1
Santoflex 6PPD	2.5	2.5		2.5
Hydrocarbon Wax (C19-C37)	2.0	2.0		2.3
Misc. Extractables*	0.5	0.5		0.6
Sulfonamide (TBBS)	1.0	0.3		0.7
Santogard PVI	0.3	0.1		0.2
Sulfur	1.9			0.9
TOTALS	179.4	14.6	17.6	156.6

Calculated Ash Content.....	9.8%
Calculated Extractables.....	8.1%
Calculated Carbon Black.....	25.0%
Calculated Density (Mg/m ³).....	1.145

*Comments: It may contain rosin acids, accelerator fragments and other reaction products, etc.

Note: Reconstructed formulation is based on analytical data from your sample. The above calculated percentages are based on the reconstructed formulation.



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Tertiary amine-free and tin-free catalysts for lower density polyurethanes

by Stephen Cavender and Rajeshkumar K. Patel, Patcham

Polyurethanes are addition polymers prepared by reacting polyfunctional isocyanates with polyols. Today, there is a vast array of polyols and quite a few polyfunctional isocyanates, giving rise to many potential polyurethanes covering an array of end-products.

Chemical reactions take place between these liquid components, producing high molecular weight, "solid" polymers. The reaction between polyisocyanates and polyols is the actual urethane reaction, and is also termed the gel reaction. Additional primary and secondary reactions occur during the urethane curing process, most prominent of which is the reaction of isocyanate with water that is either incorporated into the formulation or present from moisture in polyol components or from air. A byproduct of this reaction, carbon dioxide gas, can be captured in the polyurethane matrix, giving rise to foams for sponge-like materials, or for density reduction in elastomeric type products. This isocyanate/water reaction is termed the blow reaction. The blow reaction is often the first reaction to occur, and as such is also referred to as the initiating reaction. Some systems are formulated containing a larger amount of water in order to utilize the blow for significant gas generation, as in the production of "water-blown" foams.

While the blow reaction is commonly employed to create foam, supplemental, physical blowing agents are frequently incorporated, as well. These materials boil at relatively low temperatures, utilizing heat either generated from the blow and gel reactions, or externally applied.

Another prominent reaction is isocyanate reacting with isocyanate. This polymerization reaction produces a high proportion of trimers, and is mostly referred to as trimerization. It has more significance in systems with a high isocyanate index of $>>100$. Polymerization of the isocyanate and subsequent reaction with polyols produces polyisocyanurates, which are more rigid and fire resistant than their polyurethane counterparts.

Catalysts are employed to bring about these reactions in a workable timeframe and to reduce the amount of supplemental, external heat that may otherwise be needed.

Polyurethane formulators are aware that polyurethane catalysts are from two distinct chemical types: tertiary amines and metal based materials. These catalysts normally have some activity in all three of these primary reactions: gel, blow and trimerization. But they are often generalized according to the reaction that they have the most effect upon. For example, tin catalysts demonstrate low activity towards the blow reaction, but substantial activity towards the gel reaction. They are routinely called a gel catalyst.

Catalysis of the blow reaction tends to occur by an alkaline mechanism, which is highly suited to amines which can be quite strongly alkaline. Conversely, metal carboxylates, the most commonly employed of which are tin, bismuth and zinc, tend to be Lewis acids, and hence, demonstrate little activity here.

Quite an array of tertiary amine catalysts is employed in the industry, and they are often marketed for the blow, gel or trimerization reactions according to their predominant efficacy. Several metal based catalysts are also employed, and they are individually marketed for gel or trimerization reactions, but not for the blow reaction.

Although metal based catalysts have found acceptance in many commercial coatings, adhesives, sealants and elastomers (C.A.S.E.) applications, their use in urethane based flexible and semi-flexible foams has been limited due to their poor efficacy at catalyzing the required blow reaction. Tertiary amines are currently the industry standard polyurethane foam blow catalyst.

Essentially, the blow reaction, directly and indirectly through the effect of its exothermic activity upon incorporated physical blowing agents, generates gas that creates foam, and the gel reaction seals the foam matrix in place. Formulation of polyurethane foams and MUEs (microcellular urethane elastomers) required these competing blow and gel reactions to be synchronized/balanced. Insufficient or slow gelation and the foam structure will collapse, while overly aggressive gel reaction will create thick, irregular cell walls and cause cracking when gas is subsequently generated. Both scenarios create material with far higher density than required.

Reaction rates between isocyanate and polyol vary according to the chemical structure of these raw materials; a gel/blow catalyst combination for one system may not provide the desired balance for another. Reaction rates of gel and blow must be carefully balanced in each individual system, which is achieved by adjusting the amounts of blow and gel predominant catalysts incorporated. Further, synergy is often observed between tertiary amine and metal based catalysts, and between different types of metal based catalysts when used together.

While tertiary amines are effective, the vast majority of them have one or more highly undesirable characteristics; that is, they have foul odors, high volatility, low flash point, corrosiveness, high cost and significant toxicity. Emission of volatile tertiary amines during foam processing may cause loss of activity, while subsequent emissions from the resulting consumer products may produce other liabilities.

Tin based catalysts have become the preferred catalysts for the gel reaction. While they have not been banned, they are under scrutiny due to toxicity concerns. Also, many show hydrolysis issues that cause them to lose activity upon storage in a polyol/water component system.

Chemical "sustainability" is of increasing importance; and innovations that can replace substances possessing harmful properties with those that are more agreeable is an ongoing requisite.

Today, blow/gel balanced catalyst combinations employed in foamed urethanes are primarily combinations of tertiary amines and tin catalysts, and the tin catalyst is usually stannous octoate. Yet, there is a desire for replacement of both.

Table 1 - results for example 1

<i>1.5 pcf soft foam Bunstock</i>	<i>Conventional catalysts</i>	<i>Amine-free and tin-free</i>
3,000 MW conventional polyol	100	100
Silicone surfactant	0.80	0.80
Tertiary amine blow catalyst	0.3	-
Tin gel catalyst	0.20	-
PAT cat 4302 (blow/gel balanced catalyst)	-	2.00
Water	4.5	4.5
TDI (Iso index 105)	54.86	54.86
Cream time/seconds	8	11
Rise time/seconds	65	107
Sigh back/inches	1/8"	1/8"
Density/pcf	1.50	1.48
Comments	Good foam	Good foam

This invention is directed to a liquid, balanced polyurethane catalyst combination that can be used by itself or in combination with supplemental gel or blow predominant catalysts to achieve an array of desired blow/gel balances. All three are free from tertiary amines and free from all tin catalysts, including stannous octoate.

It is unique in that prior catalyst inventions advocate the use of tertiary amines and or tin based catalysts in part or whole for balanced catalysis of the gel and blow reaction for production of low density urethane products.

Experimental and results

Example 1

In this example, a 1.5 pcf soft foam was prepared using a conventional tertiary amine/stannous octoate catalyst combination and a comparable product made without tertiary amine or tin catalysts (table 1).

Table 2 - results for example 2

<i>One shot flexible slabstock foam</i>	<i>Conventional catalysts</i>	<i>Amine-free and tin-free</i>	<i>Amine-free and tin-free</i>
3,000 mol wt. polyether triol	100	100	100
Silicon surfactant	1.1	1.1	1.1
Tertiary amine blow catalyst	0.3	-	-
Stannous octoate (tin-based gel catalyst)	0.2	-	-
PATcat 4302 (blow/gel balanced catalyst)	-	2	2.5
Water	4.5	4.5	4.5
TDI	59.9	59.9	59.9
Cream time (seconds)	15	14	14
Top of the cup (seconds)	72	62	51
Rise time (seconds)	127	130	116
Immediate foam height (cm)	16.7	16	16.9
Remark	Good foam	Good foam	Good foam

Table 3 - results for example 3

<i>Spray foam</i>	<i>Conventional catalysts</i>	<i>Amine-free and tin-free</i>
Aromatic, high functionality polyester polyol	60	60
High functional mannich polyether polyol	30	30
High functional polyether polyol	10	10
Flame retardant	13	13
Water	2.5	2.5
Silicone surfactant	1.5	1.5
Tertiary amine blow catalyst	0.5	-
Tin based gel catalyst	0.3	-
PATcat 4302 (blow/gel balanced catalyst)	-	0.75
PATcat 21003 (blow predominant catalyst)	-	1.2
HFO blowing agent	10	10
Polyisocyanate based on MDI	156	156
Cream time (seconds)	10	9
Top of the cup (seconds)	23	21
Rise time (seconds)	50	49
Foam height (cm)	17.3	17.3
Remark	Good foam	Good foam

Example 2

In this example, a one-shot flexible slabstock foam was produced using conventional tertiary amine/stannous octoate a catalyst combination and a comparable product made without tertiary amine or tin catalysts (table 2).

Example 3

In this example, a spray foam was produced using a conventional tertiary amine/tin based catalyst combination and a comparable product made without tertiary amine or tin catalysts (table 3).

Example 4

In this example, a polyether based microcellular urethane elastomer footwear sole was produced using a conventional tertiary amine/tin based catalyst combination and a comparable product made without tertiary amine or tin catalysts (table 4).

Table 4 - results for example 4

<i>MUE (polyester) footwear soles</i>	<i>Conventional catalysts</i>	<i>Amine-free and tin-free</i>
Polyether polyol component	100	100
Tertiary amine blow catalyst	0.93	-
Tertiary amine gel catalyst	0.39	-
Tin based gel catalyst	0.01	-
PATcat 4302 (blow/gel balanced catalyst)	-	0.4
Water	0.36	0.36
MDI based prepolymer	78	78
Cream time (seconds)	19	21
Rise time (seconds)	40	43
Tack-free (seconds)	50	52
Pinch (seconds)	80	70
Density	0.133	0.135

Table 5 - results for example 5

MUE (polyester) footwear soles	Conventional catalysts	Amine-free and tin-free	Amine-free and tin-free
Polyether polyol component	100	100	100
Tertiary amine blow catalyst	0.98	-	-
Tertiary amine gel catalyst	0.44	-	-
Tin based gel catalyst	0.01	-	-
PATcat 4302 (blow/gel balanced catalyst)	-	-	1.00
PATcat 21003 (blow predominant catalyst)	-	1.40	-
MDI based prepolymer	101	101	101
Cream time (seconds)	23	24	21
Rise time (seconds)	58	52	61
Tack free (seconds)	72	55	65
Density	0.213	0.208	0.220

Example 5

In this example, a polyester based microcellular urethane elastomer footwear sole was produced using a conventional tertiary amine/tin based catalyst combination and a comparable product made without tertiary amine or tin catalysts (table 5).

Example 6

In this example, a high resilience foam was produced using a conventional tertiary amine/tin based catalyst combination and a comparable product made without tertiary amine or tin catalysts (table 6).

Discussion

In all the examples, tertiary amine-free and tin-free catalyst combinations were able to be constructed that produced comparable end product properties in comparable processing times to those produced with existing, standard combinations of tertiary amines and tin based catalysts that they were compared against.

However, they were not drop-in replacements, and as such, use levels were quite different.

Conclusion

This technology has the potential to eliminate the use of tertiary amine cata-

Table 6 - results for example 6

HR foam	Conventional catalysts	Amine-free and tin-free
Polyester polyol dispersion	100	100
Water	2.8	2.8
Crosslinker	2.9	2.9
Surfactant	1.1	1.1
Tertiary amine blow catalyst	0.12	-
Stannous octoate (tin based gel catalyst)	0.04	-
PATcat 4302 (blow/gel balanced catalyst)	-	0.64
TDI (at index 105)	33	33
Top of the cup (seconds)	92	78
Rise time (seconds)	165	150
Tack-free (minutes)	90	80
Initial foam height (cm)	15	14.9

lysts and tin based catalysts, particularly stannous octoate, in urethane polymers, and represents a potential major improvement in sustainability.

These tertiary amine-free/tin-free catalysts are patent pending.

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Meetings

44th Annual Tire Society Conference held

The Tire Society announced its 44th Annual Conference, to be held September 23-25 at the University of Akron in Akron, OH. The Conference theme is Rolling Towards Sustainability: Tires for A Greener Future. This technical event for new tire science and technology will include a keynote address, a plenary lecture, an awards banquet with an invited speaker, and more than 25 technical presentations by tire scientists from around the world.

Registration includes play-on-demand replays of the technical presentations and annual Tire Society membership, which provides full access to over 50 years of articles from the *Journal of Tire Science and Technology*.

This year's keynote address will be

delivered by Surendra Chawla. Chawla spent 40 years at Goodyear Tire & Rubber, rising through a number of positions to be the director of corporate research, and retiring as senior director, global innovation. At Goodyear, Chawla led teams focused on exploring, assessing and bringing into Goodyear new technologies for sustainable product and process leadership. He was also involved with creating new business opportunities in the connected, autonomous, shared and electrical (CASE) vehicle mobility space. His contributions to tire science are widespread, ranging from teaching young engineers at the University of Akron to a being a founder of the Goodyear Institute of Technology, to creating a research and development open innovation network of

universities, research institutes, national laboratories and industrial partners.

After his retirement, Chawla joined the Polymer Industry Cluster as leading consultant during its startup phase, culminating with the Greater Akron region being designated as the Sustainable Polymers Tech Hub by the U.S. Economic Development Administration (EDA), winning a sizable grant for this designation, as well as earning an Innovation Hub award from the State of Ohio. His experience is well aligned with the conference sustainability theme.

For the first time, the plenary lecture will be delivered by two speakers, both from Michelin. Frederic Biesse is a senior fellow, tire physics and performance modeling, and Damien Lim is a senior

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Meetings

principal researcher, physics and modeling. Biesse has worked for 26 years at Michelin's Clermont-Ferrand research and development center in France, focusing on noise, wear and rolling resistance, rising to manager of the tire performance analysis team. Lim has worked for 14 years at the Michelin Americas research and development center, with experience in test engineering and NVH, and

is currently specializing in fundamental studies on tire wear and the development of predictive tools and testing for the tire wear performance team.

Also in keeping with the sustainability theme, this year's banquet speaker will be Scott Sass, director of technology at Alterra Energy, LLC. Alterra has developed a continuous thermochemical liquefaction (pyrolysis) process, operated at scale, to recycle plastics that cannot typically be recycled into feedstock for manufacturing new plastics. Founded in 2009 as a small garage operation, Alterra currently processes 60 tons of plastics per day in its pilot plant, applying its advanced recycling technology to reduce plastic pollution. This important work addresses the challenging issue that only 10% of plastics are recycled, and contributes to the circular economy.

The Tire Society is said to be the world's leading technical organization for the advancement of tire science, engineering and technology. Its non-profit mission is to disseminate knowledge and stimulate scientific and engineering development in tires.

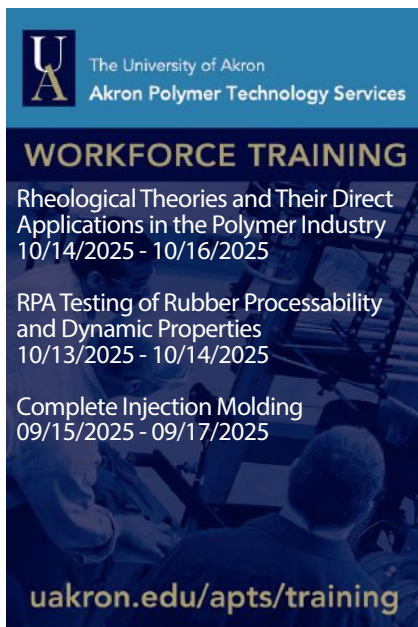
For more information about the conference, contact conference@tiresociety.org, or visit the website www.tiresociety.org.

Rubber Division, ACS plans webinar series

Rubber Division, ACS, has planned a webinar series, Formulating Fridays, to be held from noon to 1 p.m. on Fridays from September 12 through December 19. The webinars will feature expert insight from 15 companies specializing in critical ingredients utilized in rubber formulations.

Dates and topics will include the following: September 12, introduction, ACE Laboratories; September 19, styrene butadiene rubber (SBR), Akron Rubber Development Laboratory; September 26, nitrile (NBR), Zeon Chemicals; October 3, EPDM, Lion Elastomers; October 10, natural rubber, Smithers; October 17, polychloroprene, Vanderbilt Chemicals; October 24, carbon black, Tokai Carbon; October 31, silica, Evonik; November 7, plasticizers, Hallstar; November 14, process oils, Ergon; November 21, sulfur and accelerators, Akrochem; December 5, peroxides, Harwick Standard/Arkema; December 12, antidegradants, Flexsys; and December 19, process aids, Struktol.

Registration is free for Rubber Division members, and costs \$599 for non-members. Further information is available at www.rubber.org.



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Industrial Trends for High Performance Sustainable Polymer Packaging
09/08/2025 - 09/10/2025

Tire Safety and Durability
11/03/2025 - 11/03/2025

uakron.edu/apts/training

Rubber Group News

The **Chemical Institute of Canada, Rubber Chemistry and Technology Division**, will hold a virtual rubber seminar on September 18. Further information is available at www.cheminst.ca/about/cic.

The **Detroit Rubber Group** will hold its fall technical meeting October 23 in Plymouth, MI. Further information is available at www.rubber.org/detroit-rubber-group-inc.

The **Energy Polymer Group** will hold its fall symposium and educational meeting September 16-18 at the Hilton Palacio Del Rio in San Antonio, TX. Further information is available at www.energypolymer-group.org.

The **Los Angeles Rubber Group** will hold a golf tournament September 15 at the Western Hills Country Club in Chino

Hills, CA. Further information is available at www.tlargi.org.

The **Mexico Rubber Group** will hold the course, Extrusion, Calendering and Molding of Rubber Compounds, instructed by Jose Gazano, on October 16 at the Rubber Chamber facilities in Mexico City, Mexico. Details are available at www.rubber.org/mexico-rubber-group.

The **MidAtlantic Rubber Group** will hold its 50th Anniversary of Lehigh University Polymer Science and Engineering Department and 2025 MARPG Joint Symposium event October 21 at Lehigh University in Northampton County, PA. Details are available at www.marp.org.

The **Ohio Rubber Group** will hold its fall technical meeting September 23 at the Hilton Garden Inn in Twinsburg, OH. Further information is available at www.ohiorubbergroup.org.



Expansion at PTE Compounding de México

PTE is an international leader in rubber compound manufacturing, with four production plants and sales offices in Europe, Asia, and North America. We specialize in producing and selling high-quality polymer compounds for industrial and automotive applications.

Our offering stands out for its flexibility in meeting market demands, supported by approximately 2,800 active formulations developed from over 1,500 raw materials. This versatility allows us to adapt to our customers' specific needs by developing and optimizing formulations that meet particular requirements while also reducing costs.

Our advanced production lines are equipped with cutting-edge technology, including weighing stations and automatic dosing for carbon black, white fillers, and process oils. This state-of-the-art equipment ensures precise material quantities,

optimizing the efficiency and quality of our products.

Looking ahead, we are excited to announce the expansion of our facilities, planned for Q1 2026, with the growth of our capacity up to 25,000 ton/year.

NEW

Data	Line 1	Line 2	Line 3
Supplier	HF-Mixing	HF-Mixing	HF-Mixing
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Chamber volume	330 l	200 l	330 l
Net volume	231 l	140 l	231 l
Number of mills	2	2	2

This expansion reinforces Our commitment to continue leading the industry by providing our customers with innovative, high-quality solutions that meet global market demands.

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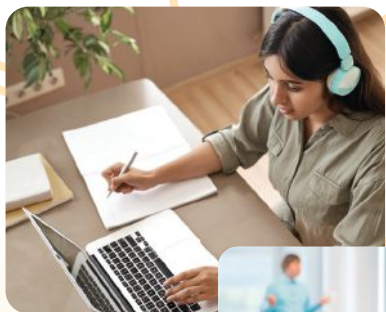
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UPCOMING LEARNING OPPORTUNITIES

- **Fridays September 12-December 19, 2025**
Webinar Series: Formulating Fridays
- **September 23, 2025**
Course: Introductory Rubber Composition & Testing
- **October 2, 2025**
Course: Processing & Testing of Rubber
- **October 8, 2025**
Course: Mastering Elastomer Molding – Reduce Costs & Improve Production Efficiency with Simulation
- **October 9, 2025**
Course: Rubber Manufacturing Economics – How to Rationalize Raw Materials, Minimize Costs & Optimize Final Properties
- **October 16, 2025**
Course: Sustainability in the Rubber Industry
- **October 22, 2025**
Course: Essential Rubber Testing – What the Data Tells You
- **October 29, 2025**
Course: Advanced Rubber Compounding
- **November 5, 2025**
Course: Rubber Explained
- **November 6, 2025**
Course: Dynamic Viscoelastic Properties
- **November 12, 2025**
Course: An Introduction to Continuous Vulcanization
- **December 4, 2025**
Course: A Static, Dynamic & Fatigue Characterization Testing
- **December 9, 2025**
Course: Essentials of Rubber Technology
- **December 10, 2025**
Course: Mixing & Testing for Compound Consistency

All webinars are FREE for Rubber Division, ACS Members and all Rubber Division, ACS courses are FREE for undergraduate Student Members (discount for masters & graduate Student Members)!

Calendar



Future
Meetings/
Expos

2025
Cleveland September 8-11
2026
Warrensville Hts. April 14-16
Louisville Sept. 28 - Oct. 1
www.rubber.org

Rubber Division, ACS, Formulating Fridays webinar, www.rubber.org - September 12.

Los Angeles Rubber Group, golf tournament, Western Hills Country Club, Chino Hills, CA, www.tlargi.org - September 15.

Energy Polymer Group, fall symposium and educational meeting, Hilton Palacio Del Rio, San Antonio, TX, www.energy-polymergroup.org - September 16-18.

University of Akron, Akron Polymer Training Services, Elastomer Molding Technology online course, www.uakron.edu/apts/ - September 17-19.

Chemical Institute of Canada, Rubber Chemistry and Technology Division, virtual rubber seminar, www.cheminst.ca/about/cic - September 18.

University of Akron, Akron Polymer Training Services, ASTM Rubber Testing: Selecting, Performing and Interpreting ASTM Rubber Test Methods course, National Polymer Innovation Center, Akron, OH, www.uakron.edu/apts/ - September 18-19.

Nova-Institute GmbH, Renewable Materials Conference 2025, Siegburg/Cologne, Germany, <https://renewable-materials.eu/> - September 22-24.

Ohio Rubber Group, fall technical meeting, Hilton Garden Inn, Twinsburg, OH, www.ohiorubbergroup.org - September 23.

The Tire Society, 44th Annual Conference, University of Akron, Ohio, www.tiresociety.org - September 23-25.

University of Akron, Akron Polymer Training Services, Exploring Color Measurements and Tolerance course, National Polymer Innovation Center, Akron, OH, www.uakron.edu/apts/ - September 24-25.

TechnoBiz, Latex Week 2025, Chennai, India, <https://conference.technobiz.org> - September 24-26.

Ohio Rubber Group, golf outing, Silver Lake Country Club, Stow, OH, www.ohiorubbergroup.org - September 25.

University of Akron, Akron Polymer Training Services, Understanding Dynamic Properties of Rubber and Rubber Products online course, www.uakron.edu/apts/ - September 25-26.

October

Rubber Division, ACS, Processing and Testing of Rubber online course, www.rubber.org - October 2.

University of Akron, Akron Polymer Training Services, Rubber and Plastics Failure Analysis: Physical and Chemical Analysis Techniques online course, www.uakron.edu/apts/ - October 2.

University of Akron, Akron Polymer Training Services, An Introduction to Continuous Vulcanization and CV Processes online course, www.uakron.edu/apts/ - October 3.

University of Akron, Akron Polymer Training Services, Applications of FTIR in Polymer Processing and Product Development online course, www.uakron.edu/apts/ - October 3.

University of Akron, Akron Polymer Training Services, Silicone Elastomer Technology online course, www.uakron.edu/apts/ - October 7-9.

Rubber Division, American Chemical Society, Mastering Elastomer Molding: Reduce Costs and Improve Production Efficiency with Simulation course, Akron Rubber Development Laboratory, Barberton, OH, www.rubber.org - October 8.

University of Akron, Akron Polymer Training Services, Rubber Technician Training online course, www.uakron.edu/apts/ - October 8-10.

Rubber Division, American Chemical Society, Rubber Manufacturing Economics: How to Rationalize Raw Materials, Minimize Costs and Optimize Final Properties online course, www.rubber.org - October 9.

University of Akron, Akron Polymer Training Services, Aircraft Tire Technology online course, www.uakron.edu/apts/ - October 9.

University of Akron, Akron Polymer Training Services, RPA Testing of Rubber Processability and Dynamic Properties online course, www.uakron.edu/apts/ - October 13-14.

University of Akron, Akron Polymer Training Services, Rheological Theories and their Direct Applications in the Polymer Industry online course, www.uakron.edu/apts/ - October 14-16.

Mexico Rubber Group, Course: Extrusion, Calendaring and Molding of Rubber Compounds, Rubber Chamber Facilities, Mexico City, Mexico, www.rubber.org/mexico-rubber-group - October 16.

Rubber Division, ACS, Sustainability in the Rubber Industry course, ACE Laboratories, Ravenna, OH, www.rubber.org - October 16.

MidAtlantic Rubber and Plastics Group, 50th Anniversary of Lehigh University Polymer Science and Engineering Department and 2025 MARPG Joint Symposium event, Lehigh University, Northampton County, PA, www.marpg.org - October 21.

University of Akron, Akron Polymer Training Services, Thermoplastic Materials Engineering Synthesis Structure Properties and End Use Performance online course, www.uakron.edu/apts/ - October 21-23.

Rubber Division, ACS, Essential Rubber Testing: What the Data Tell You online course, www.rubber.org - October 22.

Detroit Rubber Group, fall technical meeting, Plymouth, MI, www.rubber.org/detroit-rubber-group-inc - October 23.

University of Akron, Akron Polymer Training Services, The Polymer and Plastics Industry: An Introduction to Commodity and Specialty Polymer Materials Markets and Fabrication Processes online course, www.uakron.edu/apts/ - October 27-29.

Rubber Division, ACS, Advanced Rubber Compounding course, ARDL, Barberton, OH, www.rubber.org - October 29.

November

University of Akron, Akron Polymer Training Services, Rubber Compounding and Process Troubleshooting online course, www.uakron.edu/apts/ - November 4.

Rubber Division, ACS, Rubber Explained online course, www.rubber.org - November 5.

University of Akron, Akron Polymer Training Services, Advanced Elastomer Molding Technology online course, www.uakron.edu/apts/ - November 5-7.

Rubber Division, ACS, Dynamic Viscoelastic Properties online course, www.rubber.org - November 6.

University of Akron, Akron Polymer Training Services, Understanding Raw Materials: The Building Blocks of Rubber Compounding online course, www.uakron.edu/apts/ - November 10.

University of Akron, Akron Polymer Training Services, Solving Problems in Rubber Compounding and Processing online course, www.uakron.edu/apts/ - November 11.

Rubber Division, ACS, An Introduction to Continuous Vulcanization online course, www.rubber.org - November 12.

University of Akron, Akron Polymer Training Services, Polymer Compounding Formulating and Testing of Rubber Adhesives and Coatings online course, www.uakron.edu/apts/ - November 12-14.

Medical grade thermoplastic elastomers

The company's medical grade thermoplastic elastomer (TPE) portfolio has been expanded with grades specifically designed for biopharmaceutical tubing applications. Medical device manufacturers are said to choose thermoplastic elastomers (TPEs) for applications that require flexibility or rubber-like elasticity, and they are said to turn to the company to deliver high quality, regulatory compliant Medalist TPEs with a proven track record.

These innovative Medalist Series products are tailored to address the unique challenges associated with the continuous processing of biopharmaceuticals through roller pumps, according to the manufacturer.

Medalist MD-90000 Series TPE grades are said to offer a compelling combination of performance benefits, including:

- Enhanced clarity: Improved transparency for visual inspection of fluid flow and potential particle



contamination

- Reduced spallation: Minimized material loss and contamination risks during extended pump operation
- Extended pump life: Increased durability and longevity of tubing, reducing maintenance requirements and downtime

These advanced materials are said to be ideal for a wide range of biopharmaceutical applications, including single-use systems, bioreactors, filtration systems and fluid transfer lines.

The company produces flexible and rigid vinyl, thermoplastic elastomers, nylons, engineering TPEs, thermoplastic vulcanizates, color masterbatches, specialty chemicals and garden hoses, and offers custom compounding. (*Teknor Apex*)

www.teknorapex.com

Soft touch, durable TPEs

Thermolast R sustainable thermoplastic elastomer (TPE) is said to deliver lasting durability, strong adhesion and processing efficiency, and are said to be ideal for grips, anti-slips and soft touch surfaces in electric shavers and consumer devices. The Thermolast R series TPE is suitable for multi-component injection molding, offering good flowability, superior mechanical properties and excellent adhesion to PP, all ensuring durable component bonding and enhanced performance in electric shavers, according to the company. With a broad hardness range (30 to 90 durometer A) and temperature stability up to 80°C, the TPE series provides outstanding wear resistance and long lasting reliability, even with frequent use, according to the company. (*Kraiburg TPE*)

www.kraiburg-tpe.com

Butyl, halobutyl solutions

Exxon butyl rubber (IIR) is said to be the foundation of today's butyl rubber technology. It is a copolymer of isobutylene and a small amount of isoprene, providing for a highly saturated backbone. Thanks to excellent air-barrier performance, aging resistance, flex fatigue resistance and vibration damping, Exxon butyl rubber plays a crucial role across different applications, such as tire innertubes, curing bladders and envelopes, hoses, adhesives and sealants, and many other rubber goods suitable for industrial and consumers applications, according to the company. Exxon chlorobutyl rubber (CIIR) is said to provide an improved compression set and better resistance to heat, ozone and flex fatigue compared with regular butyl rubber, while maintaining the same excellent air-barrier properties. (*Vanderbilt Chemicals, LLC*)

www.vanderbiltchemicals.com

Bio-based TPU material

The Ariete 8K ski mask design is aimed at drastically reducing CO₂ emissions, and is said to combine cutting edge design, extreme technical performance and a strong commitment to environmental sustainability. Additionally, it ensures maximum safety for the wearer, according to tests conducted and required by European certification for Class II Personal Protective Equipment in compliance with EU Regulation 2016/425 and the UNI EN 1938:2010 safety standard, according to the company. The product was developed using Laripur RS, a bio-based thermoplastic polyurethane (TPU) formulated from renewable raw materials, allowing for 70% bio-based content while reducing the product's Life Cycle Assessment (LCA). This is said to ensure superior resistance, flexibility and comfort. The TPU used is composed of up to 70% raw materials from renewable sources, positioning the 8K mask among the most advanced products in the landscape of low impact technical materials, according to the company. (*Coim*)

www.us.coimgroup.com

Polyurethane encapsulant

This high performance two-part polyurethane encapsulant was formulated by the U.S. Navy and is said to exhibit excellent hydrolytic stability and exceptional acoustic properties. NUWC XP-1 polyurethane encapsulant is fully cured at room or elevated temperatures in under 24 hours. This flexible encapsulant adheres to many substrates and is said to be ideally suited for protecting acoustic equipment, hydrophones and underwater transducers, according to the company. The product is available in pints, quarts, gallons, 5-gallon pails and 55-gallon drums. (*Alfa International*)

www.alfaadhesives.com

PU foam technology

Next generation flame retardant encapsulation polyurethane foam technology is said to address one of the most critical challenges in electric vehicle (EV) adoption worldwide: battery safety. The Baysafe BEF flame retardant encapsulation foam series is designed to minimize thermal propagation between battery cells, tackling a key safety concern that has challenged consumer trust in EVs, according to the company. The lightweight foam is said to deliver superior flame retardant performance by effectively inhibiting fire spread, significantly enhancing battery safety in applications ranging from EVs to portable energy storage systems. Beyond encapsulation foams, the company is said to offer a wide range of polyurethane based solutions for EV batteries, including battery covers and shock absorbing materials. The Baysafe BEF technology is said to further strengthen the firm's position in the fast growing new energy sector, supporting safer, more reliable electric mobility applications such as new energy vehicles and e-bikes, as well as portable battery generators. With continued innovation in materials science, the company is said to be supporting the development of next generation electric transportation. (Covestro)

www.covestro.com

Sustainable TPEs

A global manufacturer of TPEs and customized solutions for various industries is said to provide high quality, sustainable TPE compounds with advanced properties to help manufacturers enhance product sustainability, while benefiting from cost-effective solutions for vehicle components such as mud flaps, seals and gaskets. With its versatility and reliability, TPE is said to be an excellent choice for automotive applications, allowing companies to meet both performance and environmental targets efficiently. A mud flap, also known as a mudguard or splash guard, is typically made of rubber, plastic or metal. The company's advanced TPE materials offer properties that ensure these components perform reliably under all driving conditions, according to the manufacturer. They are said to provide resistance to road debris, grime, weather and UV exposure, while maintaining durability, reducing the need for maintenance for vehicle users. The firm's sustainable TPEs are said to provide essential material benefits, including low density for lightweight construction and improved efficiency, thermal stability up to 90°C for reliable performance in high temperature conditions, and strong weather resistance. (Kraiburg TPE)

www.kraiburg-tpe.com

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CABLE AND WIRE WEST COAST, October 7-9, Anaheim CA



www.streckerusa.com

Polyurethane additives

For over ten years, this company and Daicel ChemTech have worked in close partnership to bring the exceptional performance of Daicel's Placel polycaprolactone polyols to the polyurethane market. With a diverse portfolio of more than 50 unique grades, Placel polyols are said to be engineered to address a wide range of formulation challenges, both common and complex, within the polyurethane elastomer industry. This longstanding collaboration is said to enable the companies to combine technical expertise and customer focused support to deliver targeted solutions tailored to customer performance goals. Whether optimizing an existing system or developing a new one, the companies are said to be ready to help customers unlock next level performance through advanced material design. Placel polycaprolactone polyols are derived from a broad array of initiators and are known for imparting outstanding properties to polyurethane elastomers, including high hydrolytic stability, superior thermal performance, durability, enhanced flex fatigue life, chemical, oil and hydrolysis resistance, excellent weatherability and UV stability, and long term performance retention, according to the company. (*Gantrade*)

www.gantrade.com

Polyurethane recycling

With Loop, the company introduces a range of polyurethane solutions incorporating recycled content, market ready and tailored for the footwear, automotive and synthetic leather industries. It starts with the firm's recyclable PU systems. The waste, a valuable resource said to turn the end into a new beginning, is segregated and shredded in a dedicated facility. There, the patented PU recycling technology uses a combination of sophisticated advanced liquification techniques to recycle polyurethanes solutions into high quality recycled materials that meet industry standards and has strong commercial viability, according to the company. Finally, the recycled raw materials are used to make new PU solutions, transforming Loop into a reality for polyurethanes. Polyurethanes have traditionally been difficult to recycle, according to the company. Over the past several years, the firm is said to have made significant investments to develop this PU recycling technology. It is not only a significant advancement in technology, but also sustainable management of PU materials, according to the firm. The Loop recyclable PU system is said to be a testament of the firm's commitment to innovation in recycling. (*BASF*)

www.basf.com

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NORST® PIB-graft-PIB Bi-Modal Butyl Alloys

NORST® PB-402 and PB-403 are PIB-graft-PIB viscous fluids for use in cable fill, sealants and polyolefin PSA's and for boosting performance in low-styrenic block copolymers and low VAC ethylene copolymers. NORST base polymers are non-drying, non-migrating with very high gas barrier performance; cold flex down to -50 C; and cold temperature tack strength. They can be used as part substitutes for non-polar tackifier resins. These PIB alloys have polydispersity (Mw/Mn) above 30 and are unique in the industry with unmatched tack strength and high temperature resistance.

NORST® PIB-graft-Ethylene/Propylene High temperature – High elastic bond performance

PB-400 PB-500 PB-600 PB-800 PB-1620

The PB-series is listed in increasing high temperature adhesive shear strength. Any of these can be blended for tailored, tack, peel and shear. Preferred tackifier resins are C5 hydrocarbons. NORST base polymers exhibit superior bonding to low surface energy substrates.

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Thermoplastic elastomers

This provider of specialty and sustainable materials solutions and services has expanded its Versaflex PF thermoplastic elastomers for surface protective films to include an ultra high adhesion series for co-extruded protective films. This technology is developed to meet the growing demand for high performance protection in the electronics, appliances, building and construction, and transportation industries. With the launch of the latest Versaflex PF ultra high adhesion TPEs, the company is said to be addressing its customers' needs for advanced protective film solutions that can adapt to various surfaces and structures, including brushed metal, wood grain and painted plastics, while providing long lasting protection. This product not only offers exceptional adhesion performance after extended periods and exposure to high temperatures, but it also supports sustainability goals by reducing volatile organic compound (VOC) emissions compared to traditional solvent based coating technologies, and enabling the recyclability of the protective films as post-consumer waste, according to the company. The ultra high adhesion series leaves no residue on prism substrates following heat exposure. (*Avient*)

www.avient.com

Thermoplastic PU solution

Four biomass balance solutions are available under the thermoplastic polyurethane portfolio commercialized as Estane RNW TPU. These materials are said to have the same quality and performance as the company's standard petroleum based resins, while using more sustainable mass balanced feedstocks. The four grades, Estane RNW90 58300, Estane RNW90 58887, Estane RNW85 GP52DT and Estane RNW60 ZHF90AT2 TPU, are fully commercially available, with Estane RNW60 ZHF90AT2 TPU being consistently applied in cable applications that are flame retardant, according to the firm. This TPU series is said to have a product carbon footprint reduction up to 59%. These materials provide the same high quality and performance, while using bio and/or biomass balanced feedstocks. The company is said to be leading sustainability by offering its own solutions as Estane RNW TPU and Estane ECO TPU, and supporting its customer's target of carbon reduction by positioning its portfolio in material replacement projects. The biomass balance product line is said to be an example of working in collaboration with customers and the firm's focus on market trends. (*Lubrizol*)

www.lubrizol.com

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TPU footwear solutions

A range of high performing thermoplastic polyurethane (TPU) materials has been developed for the footwear industry that is said to offer game changing possibilities for soling applications. The Avalon Gecko TPU portfolio offers a series of products that have exceptional grip and durability, and have been developed with circularity in mind, according to the company. Tailor made for use in high performance soling applications, the range includes an extrudable grade for creating super thin outsoles, and a product that can be foamed to produce a very low density and super soft material with a unique touch and feel. Drawing inspiration from the extraordinary grip of geckos, products in the Avalon Gecko TPU portfolio are said to offer comparable slip performance to rubber in both wet and dry conditions. Said to be a great choice for outsoles for running, hiking and safety shoes, the Gecko TPU portfolio contains products that are soft (durometer 60-65A), yet highly durable with excellent abrasion resistance, according to the company. To help ensure ultimate design and production versatility for its customers, the firm has developed three grades of Avalon Gecko TPU, including opaque and transparent versions. (*Huntsman*)

www.huntsman.com

Custom engineered TPEs

This global manufacturer of thermoplastic elastomers (TPEs) is said to offer high quality, custom engineered materials for a wide range of consumer, industrial and regulated product applications. Properties such as durability, chemical resistance, biocompatibility and more make their TPEs well suited for anti-snore devices and other medical products, according to the firm. TPE grades are said to meet strict global safety standards for medical technology, including US FDA CFR 21 raw material compliance, EU food contact regulation No. 10/2011, in vitro cytotoxicity requirements for medical devices as specified in DIN ISO 10993-5 and GB/T 16886.5 (China), as well as RoHS and REACH regulations. These TPEs are free from animal ingredients, PVC, silicone and latex, making them suitable for a wide range of medical devices, according to the firm. The compounds offer a soft surface, flexibility, high elasticity and low friction, ensuring excellent comfort and durability, even with extended use of anti-snore devices, according to the company. Available in translucent and transparent options, these materials can be colored to enhance aesthetics and allow customization to fit specific product requirements. (*Kraiburg TPE*)

www.kraiburg-tpe.com

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Injection molding machine

A highly automated production cell is offered in which gas diffusion layers (GDLs) for fuel cells are encapsulated with a liquid silicone rubber (LSR) seal. This application is said to serve as a prime example of how sensitive functional elements made of film material can be overmolded with LSR economically, safely and precisely thanks to highly precise process control, said to be a key process for series production in the field of hydrogen mobility. The GDL foils are integral components of fuel cells, ensuring the even distribution of reaction gases across the catalyst layer, while also conducting electrons and draining water. To fulfil this role, they must be sealed with absolute precision without impairing their diffusion function, according to the company. This places the highest demands on the precision of the injection molding process, the interplay between mold, machine and automation, as well as on the economic efficiency of production, according to the firm. (Engel)



www.engelglobal.com

Extrusion crosshead

A single-point concentricity extrusion crosshead uses micro-fine adjustment screws for precise concentricity adjustment. The precision of concentricity reaches 0.008" or finer per revolution, according to the company. This single point concentricity adjustment is said to be a unique innovation for the extrusion of thin-walled jacketing and precision ID/OD tubing. One adjustment bolt controls 360° of adjustment. Features of the single-point crosshead include a patented camlock deflector for quick changeovers, with a residence time of one minute at .5 pound/hour material flow, optimized usage with extruders measuring 1/2" and 3/4", and a maximum die ID of .250". Additionally, the single-point crosshead is said to offer great flexibility to its users. It not only accepts both vacuum and micro-air accessories, but is also ideal for pressure and sleeving applications, according to the company. Fluoropolymer designs are available upon request. (Guill Tool & Engineering)



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Compounding systems

Compounding systems for abrasive, temperature sensitive and high-fill applications, as well as recycling solutions, are available from this global designer and manufacturer. WF Recycle-Tech, in which the firm is a partner and principal owner, provides a patented end-of-life tire pyrolysis system that incorporates the company's FCM continuous mixer into its process. The CPeX laboratory compact processor is a laboratory scale processor utilizing the firm's proven continuous mixing technology. With a nominal throughput of 30 kg/hour and both standard and CPXL rotor configurations, the CPeX is said to enable rapid product development, application testing and time-to-market reduction. The Ampacet SpectroMetric 6 inline color correction feeding system, along with the CPeX, maximizes post-consumer recycled content usage while maintaining precise color control, according to the company. A continuous mixer includes a large feed hopper for ingestion of irregularly shaped material, crammer options for low bulk density feeding, proprietary hard surface coatings for maximum wear, a patent pending grooved mixer feed section and a vent capture system. (Farrel Pomini)


www.farrel-pomini.com

Micro molding machine

The M3 is a fully automated manufacturing cell designed for the high volume production of direct gated precision micro parts, completely waste-free and with unmatched consistency, according to the manufacturer. The M3 is engineered for mass production of complex micro molded parts weighing under 200 milligrams, including components as small as 10 milligrams or less. It is said to achieve this with no cold runner, eliminating material waste and reducing cycle time. This results in millions of identical parts at the highest level of quality, according to the company. Despite its high degree of standardization, the M3 is designed to be flexible. Modular base tooling allows for interchangeable inserts, side actions, core pulls and ejectors, enabling the production of highly complex part geometries. Its integrated 8-drop valve gate hot runner system is permanently mounted to the machine. The M3 processes any thermoplastic material, including high temperature engineering polymers. (Mold Hotrunner Solutions)



www.mhs-hot-runners.com




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Durability test software

The Endurica MP durability solver calculates self-heating, oxidation and aging in elastomers. The abbreviation MP stands for multiphysics. The solver is said to integrate with the company's other fatigue solvers (CL, DT and EIE) to provide an unmatched capability for simulating a broad range of degradation mechanisms. Endurica MP offers workflows for steady state and transient thermal analysis, prediction of thermal runaway, oxygen diffusion analysis and analysis of chemical reactions such as oxidation. Users of Endurica MP can predict tire rolling resistance and energy loss distribution; avoid thermal failure modes induced by self-heating, aerobic and anaerobic aging, or oxidation; execute durability simulations that account for the combined effects of oxygen and thermal history; diagnose and resolve temperature dependent issues arising from material properties, component geometry and load factors to get durability right; calculate fatigue life and failure location on their part, while accounting for changes in temperature and material properties; and deploy a proven, advanced workflow that is ready to go, out of the box, according to the company. (Endurica)

www.endurica.com

Profile measurement

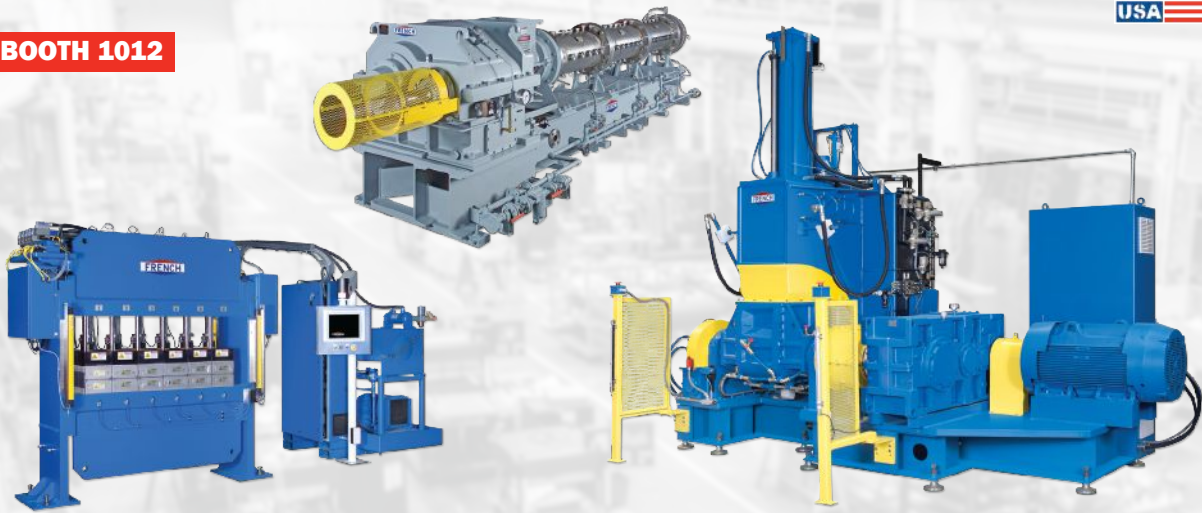
The Profile360 Blue laser profile measurement system is said to be the ideal solution for applications requiring continuous 2D profile inspection. The same industry leading standard for quality and reliability is now available at a lower price point, according to the manufacturer. Continuous real time inspection is said to assure that the operator will be alerted upon a change in profile, reducing rework and scrap. Instead of inspecting one per hour, the Profile 360 Blue captures 20 frames per second, which is said to provide improved quality. The profile measurement system is applicable across many industries, including automotive seals, PVC extrusion, wood-plastic composites, metal profiles, ceramics, and more, according to the company. The company's Profile360 continuously monitors the size and shape of complex profiles in order to assure quality and avoid the high cost of defects. The system acquires thousands of data points around the profile and matches them to a CAD template, where key measurement parameters such as width, thickness, gap, radius and angle are extracted. Measurement parameters are compared to allowable control limits and displayed on the operator's terminal with a pass/caution/fail status indicator. (Starrett Bytewise)

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Silicone rubber insulator

Elastosil R 531/60 silicone rubber is said to meet the demands on busbars of traction batteries, which basically are aluminum or copper rails that distribute the current between the battery cells and modules. As nominal battery voltages in electric vehicles are already in the range of 300 V to 900 V, the reliable insulation of these components is said to be a must. The Elastosil product is flame resistant and reliably prevents leakage currents and energy losses, according to the manufacturer. The insulation remains intact, even at operating temperatures of up to 205°C. Elastosil R 531/60 is said to have yet another important role in the safe operation of electric vehicles. In the event of a fire, the cured rubber forms a solid ceramic material that sheaths the busbar and continues to insulate it electrically, thus reliably preventing short circuits, according to the company. This protective layer remains intact even at temperatures between 800°C and 1,000°C. With a hardness of 60 durometer A, Elastosil R 531/60 is said to make processing cost-effective, as it can be applied to a busbar by extrusion. The high flexibility and tear strength of the silicone allow busbars to be bent and adapted to the surface structures of the battery without cracking. No fractures or cracks occur, even after impact tests, according to the company. (*Wacker*)



www.wacker.com

Specialty rubber additives

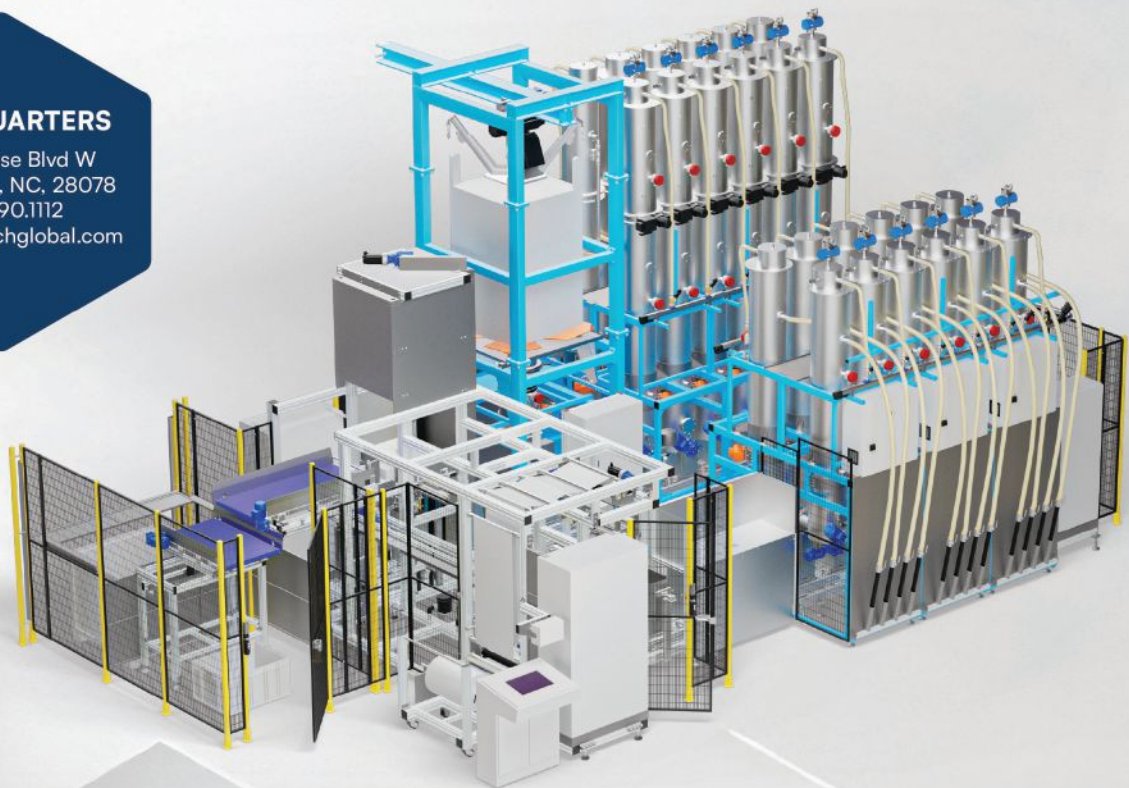
This distributor of rubber additives supplies materials said to support the evolving needs of the rubber, tire and polymer sectors. A cornerstone of the firm's silane and specialty chemical offerings, JHSI is said to have been instrumental in supplying high performance materials for tire and industrial rubber applications. Performance Additives manufactures a full line of process aids in Malaysia, and dithiocarbamate accelerators in Italy. The company is said to be committed to innovation and sustainability. Repsol is said to play a vital role in the rubber industry through its line of Redezon antiozonant waxes. Produced in Spain, these waxes protect rubber products (tires, footwear and technical goods) from ozone damage by forming a surface barrier that prevents cracking. Birch Chemicals is said to bring deep expertise in moisture scavengers and CaO masterbatch technologies, particularly for plastics and rubber masterbatch applications. Miwon is said to be a respected international specialty chemical producer, concentrating its efforts on oligomer and monomer technologies, and methacrylate based additives for the polymer compounding market. William Blythe Ltd. provides antimony-free flame retardant synergist solutions for polymer material formulators under the brand Flamtard. Ningxia Boyuan Rubber is a Chinese manufacturer specializing in CSM (chlorosulphonated polyethylene) and ECO (epichlorohydrin) elastomers. (*ChemSpec, Ltd.*)

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Silicone potting solutions

As energy supplies become increasingly decentralized, the individual components in solar photovoltaic (PV) systems, especially those critical to safety, have to meet ever more stringent reliability requirements, according to the company. Live and electronic components for outdoor use, from power electronics to safety switches, junction boxes and connectors, must be permanently protected against heat, moisture, UV radiation and mechanical stress, according to the firm. Tailored two-component silicone potting compounds are said to serve as a reliable all-around solution. RTV silicones are said to be highly adaptable, and can therefore be used in the production and long term operation of demanding PV applications. Low viscosity, free flowing two-component silicone potting compounds can be processed efficiently in automated potting processes using standard mixing and dispensing systems, according to the company. These materials are said to be the ideal choice for series production of demanding components in state-of-the-art PV systems. (*Wevo*)

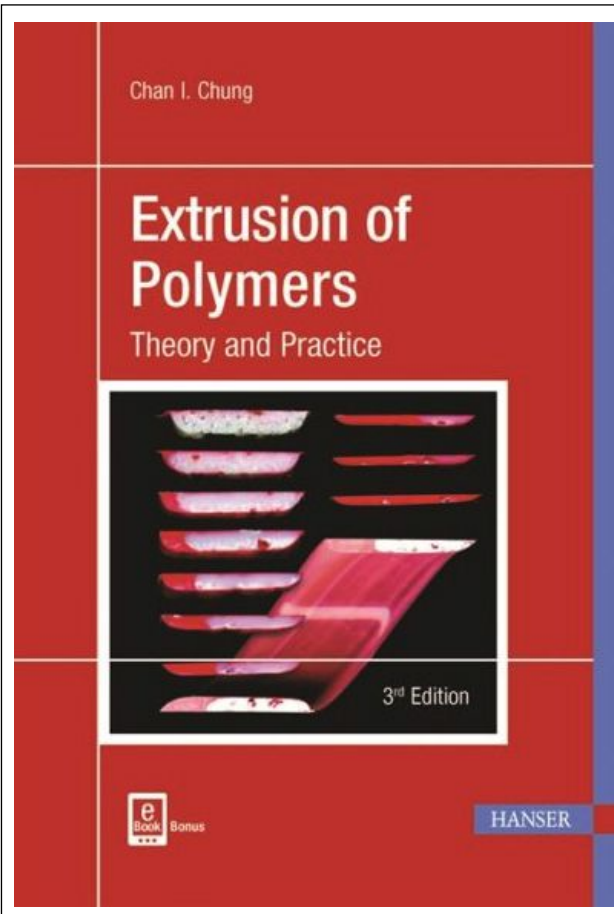
www.wevo-chemie.com



Perfluoroelastomers

Aflas FFKMs are perfluorinated elastomers that have the highest performance of any other elastomer material, according to the company. They are said to have outstanding heat and chemical resistance, which makes them suitable for use in o-rings and seals in extremely harsh and aggressive environments. Aflas FFKMs are said to exhibit the ultimate in sealing performance in critical applications. Advantages are said to include chemical resistance, oil resistance, heat resistance and high tensile strength. Applications include sealing parts for CPI, sealing parts for analytical instruments, instruments for semiconductor manufacturing and sealing parts for oil and gas, according to the company. PM-1100 can operate at 230°C continuously, with occasional peaks to 250°C. PM-3000 has a continuous service temperature of 250°C, with peak temperatures around 270°C. PM-3000 is said to have improved compression set that can sustain pressure for longer periods, which is said to mean reduced maintenance. PM-5000 is a high purity grade that achieves a durometer A hardness of 70 without the need for fillers. It is said to have plasma resistance for use in the etching process in semiconductor manufacturing. (*AGC Chemicals Americas*)

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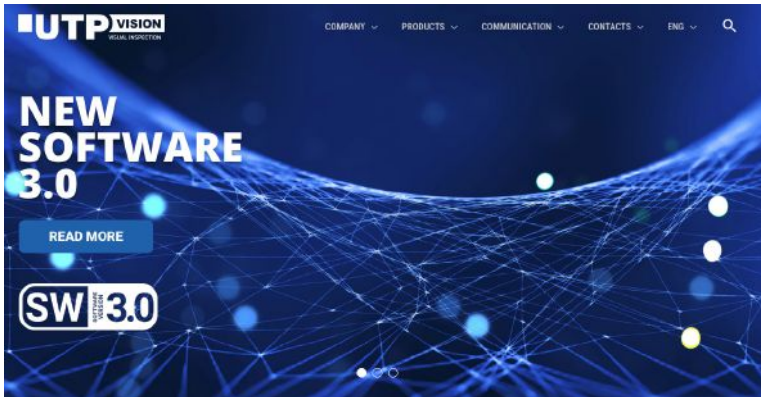
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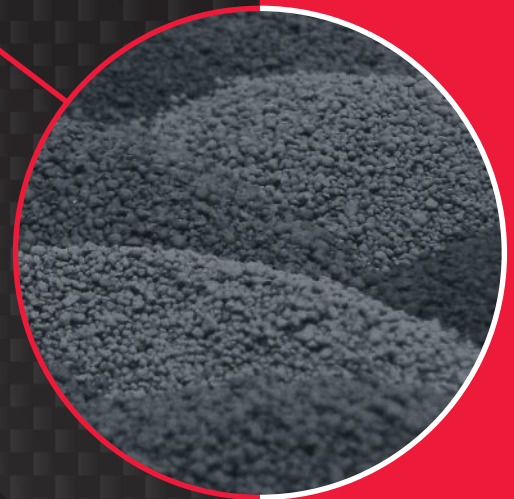
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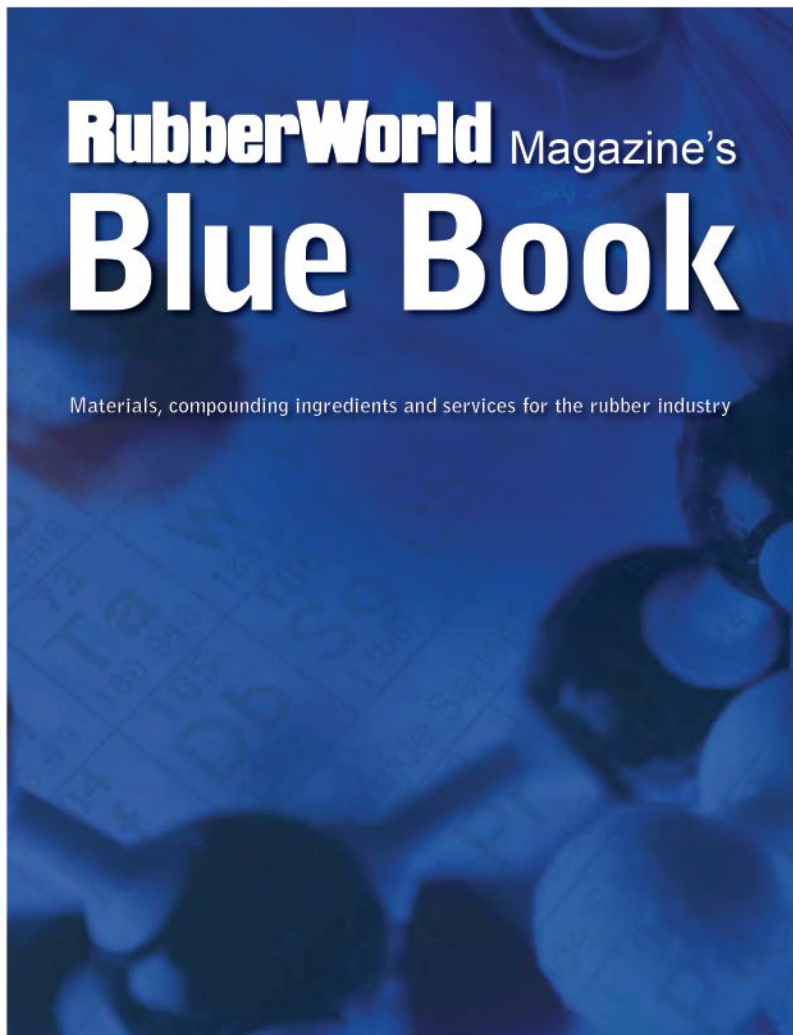
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People in the News

Alena Bauer to head Continental PR

Alena Bauer has taken over as head of Continental public relations and internal communications for the tire replacement business in Europe, the Middle East and Africa (EMEA).

SALES

Wyatt D. Hamilton, Sr., was named director of sales for the Truck Tire Replacement division of Continental Tire the Americas in the U.S.

Saurav Mukherjee was appointed senior vice president, global sales and operations, for Dunlop Tyres India.

Jan-Piet van Kesteren was appointed managing director, EMEA, and chief sales officer, EMEA consumer, for Good-year Tire & Rubber.



Alena Bauer
Continental



Wyatt Hamilton
Continental Tire



Jeff Glajch
Orion S.A.



Lutz Greb
Wacker

RETIREES

Orion S.A., a global specialty chemicals company, announced the upcoming retirement of **Jeff Glajch**, chief financial officer, who intends to step down early in the fourth quarter of 2025.

AWARDS

Lutz Greb, professor at Heidelberg University's Institute of Inorganic Chemistry, was presented with this year's Silicone Award by chemical company Wacker Chemie AG for his outstanding research.

John Sommer

Troubleshooting Rubber Problems



HANSER

Troubleshooting Rubber Problems

Problems can occur during the many steps involved in the manufacture and use of rubber products. There are challenges in selecting and combining materials to form a rubber compound, mixing and processing equipment under varied conditions, or using the finished product in different conditions and environments. From materials to processes to products, this book troubleshoots many of the different rubber-related problems and suggests approaches to solve them. Numerous case studies and references are included.

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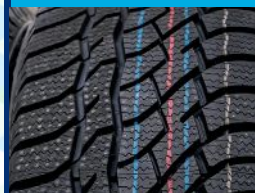
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