Picking up signals from the EV market

IMAGE: SHUTTERSTOCK AI

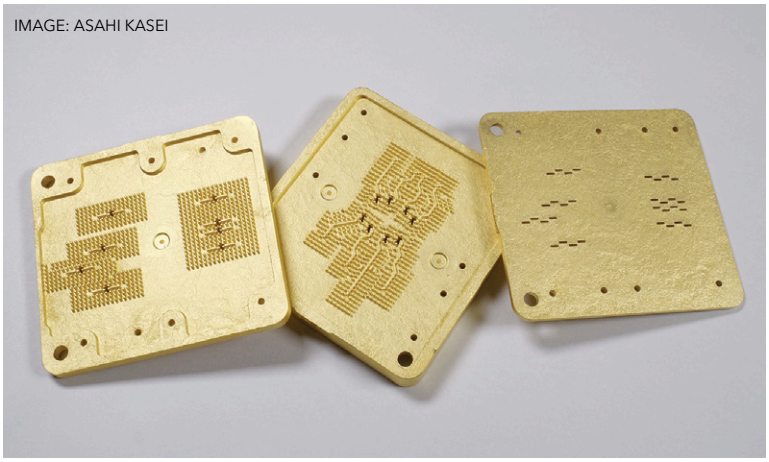
*Compounders responding to the demands of electric vehicle applications must balance an expanding range of properties in their materials. **Chris Saunders** reports on new products*

The electric vehicle (EV) industry has entered a new phase of development. While the first trends focused primarily on electrification and range, manufacturers are now concentrating on reducing costs, improving efficiency, enhancing safety, and meeting increasingly demanding sustainability targets, meaning that opportunities now exist far beyond replacing metal with plastic. The automotive industry is currently transitioning from 400V to 800V architectures as manufacturers seek to deliver faster charging, greater driving range, and improved powertrain efficiency. This move is redefining performance requirements for advanced materials which must now deliver a combination of mechanical strength, flame resistance, thermal management, electrical insulation, and recyclability, all while remaining economically viable for high-volume production.

Higher power density and ultra-fast charging generate greater thermal loads across the charging path, battery system, and electric drive components, so engineers must also maintain insulation, dimensional stability, and long-term reliability under more demanding operating conditions. "The shift to 800V is redefining the role of specialty polymers in electric vehicles," said Nicolas Batailley, EMEA Business Development Manager at **Syensqo**. "Engineers are looking for materials that can simultaneously deliver electrical performance, thermal resistance, and long-term durability, while enabling more compact, lightweight designs. That's where we see innovation in polymer compounds making a real difference for the next generation of high-voltage systems."

Recent material developments further illustrate this trend. For example, new highly flowable polyphenylene sulphide (PPS) compounds make it possible to produce ultra-thin e-compressor

IMAGE: ASAHI KASEI



Above: Metallised slotted waveguide array antenna made of Asahi Kasei's Xyron mPPE

bobbins that improve motor efficiency without sacrificing durability or electrical performance. Syensqo's Ryton PPS Supreme HF is already being used in this application. Ryton XE3500 Orange is an extrudable PPS grade developed for demanding high-voltage charging busbars, while the recently-introduced Amodel PPA AE-8945 HFFR is being used in battery protection systems such as pyrofuses.

Although technical challenges remain, companies involved in EMI shielding solutions like **Premix** are uniquely positioned to drive innovation. "Traditionally, EMI shielding in plastics has been achieved using metallic additives," explains Christine Van Bellingen, Business Development & Sales Manager, Premix. "The growing range of carbon-based conductive additives has made EMI shielding plastics a more cost-effective alternative while also reducing wear on processing equipment compared to metal fibre-based solutions. With wall thicknesses of at least 2mm, attenuation levels of 40-60 dB at medium-to-high frequencies can be achieved using highly-filled yet processable polypropylene (PP) and polyamide (PA) compounds in well-designed injection moulding tools. Thicker walls bring higher attenuations, and tailored material developments can combine EMI shielding performance with flame retardancy."

The expansion of 5G networks and the development of 6G technologies are accelerating the use of higher-frequency electromagnetic waves. While these frequencies enable faster data transmission and improved connectivity, they also introduce challenges such as increased transmission losses, signal degradation, and heat generation. Material selection becomes particularly important because dielectric properties can have a direct impact on system efficiency. This is one reason why materials such as modified polyphenylene ether (mPPE) are attracting attention in automotive communication applications.

"Unlike conventional plastics, mPPE combines excellent dimensional stability with inherently low dielectric loss characteristics," said Miki Tokuyama, Technical Engineer, Engineering Plastics Division, **Asahi Kasei.** "In high-frequency applications, a low dielectric loss tangent (Df) helps minimise signal attenuation, improving transmission efficiency and overall system performance. Millimetre-wave radar, commonly used for adaptive cruise control, collision avoidance, and object detection, relies on antenna structures and waveguide components that must maintain extremely tight dimensional tolerances, as even minor warpage or dimensional variation can affect signal quality. With dimensional stability approaching that of metals, mPPE provides a lightweight alternative while maintaining the precision required for high-frequency performance."

The material's potential extends beyond radar antennas. Antenna covers, for example, must combine low dielectric loss with weather resistance and low weight. Advanced mPPE grades offer significantly lower dielectric losses while maintaining long-term resistance to weathering, discoloration, and environmental exposure.

Communication parts

"Certain communication components require a different balance of properties," said Tokuyama. "Phase shifters used in some high-gain antenna systems benefit from materials that combine high dielectric permittivity (Dk) with low dielectric loss, alongside high heat resistance and elevated heat deflection temperatures. Meanwhile, antenna elements increasingly demand materials that can support mass production while maintaining stable thermal expansion characteristics. PPS/PPE alloy systems can address these requirements through low Dk and Df values, lightweight construction, improved plating performance, and reduced warpage. Some development-grade mPPE materials demonstrate dielectric properties as low as Dk 2.6 and Df 0.001 at 28 GHz, highlighting how far engineering plastics have advanced."

In June this year, **Avient** launched Preperm low loss dielectric thermoplastics for mmWave radar dome (radome) applications, a new mPPE portfolio with four grades created for the surge in 5G/6G-enabled radar sensing which provide Advanced Driver Assistance Systems (ADAS) component manufacturers and traffic radar system producers with a high-performance alternative to conventional glass-fibre-reinforced polybutylene terephthalate (PBT+GF) materials. The accelerating adoption of radomes is reshaping material requirements across the automotive industry. As Level 2 through Level 4

driver-assist features proliferate, the radome, the dielectric cover that protects the radar antenna, has become a make-or-break component for system performance as incumbent materials were not created for the higher frequencies (37.5 GHz to 79 GHz and above) now standard.

Manufacturers reportedly told Avient they are hitting four recurring barriers: signal loss from elevated dissipation factor values eroding detection range; narrow detection angles limiting coverage; warpage during injection moulding extending qualification timelines; and Blind Spot Information System certification hurdles blocking European market entry. The new grades can deliver a dielectric constant (Dk) of 2.53 to 2.94 and a loss tangent (Df) as low as 0.001 at 2.5 GHz, while in-house RF testing at 37.5 GHz demonstrated clear improvements in gain, elevation angle, and detection angle compared to PBT+GF materials. High-impact and reinforced laser-weldable grades address the outer radome layer's impact and structural demands, while a dedicated laser-absorbing grade serves as the base layer, enabling fully-welded assemblies compatible with laser assembly processes.

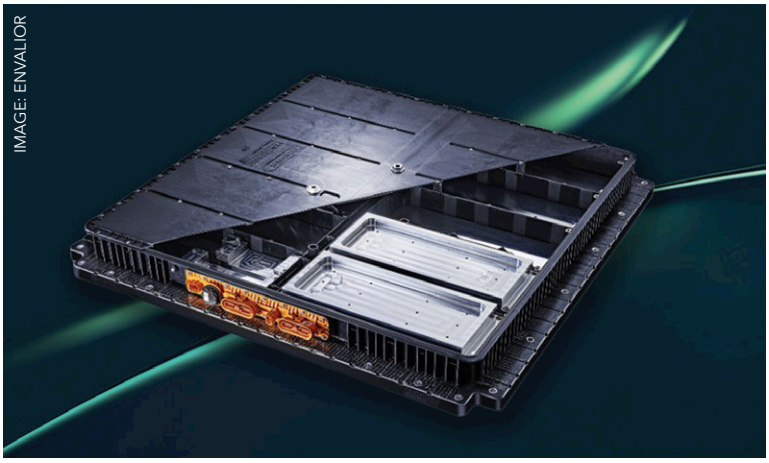


IMAGE: ENVALIOR

"Tier 1 automotive suppliers in Asia were hitting real performance ceilings with PBT+GF materials," said Flight Xu, General Manager, Specialty Engineered Materials, Asia, at Avient. "Traditional polyesters could not deliver stable dielectric values at high frequencies, and warpage was creating costly assembly rework. With our new Preperm materials, customers are achieving meaningful gains."

As EV charging speeds continue to increase, thermal management is becoming a critical design consideration. Ultra-fast charging generates

Above: Hybrid composite battery cover developed by Envalior in collaboration with Sabic, Siebenwurst, Ensinger, and Forward Engineering

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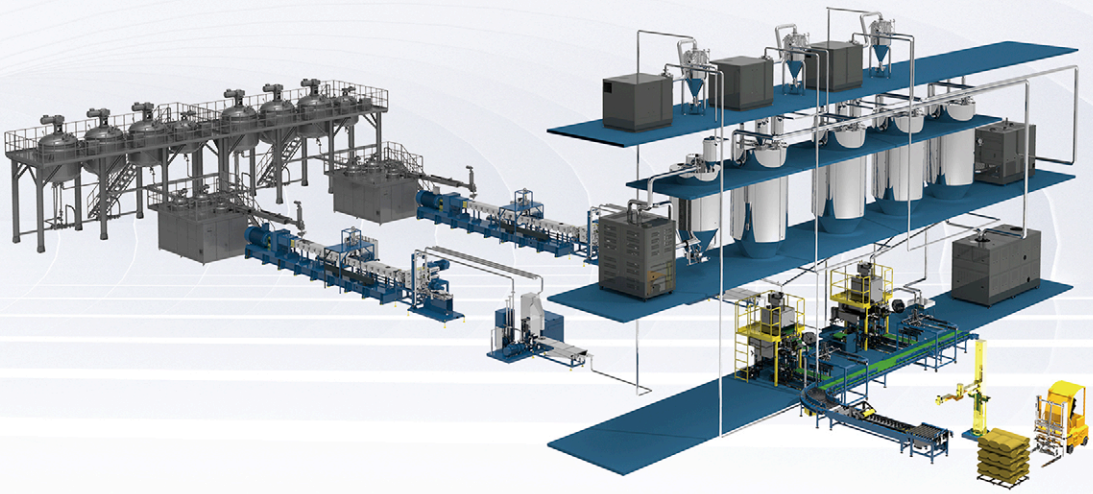

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IMAGE: CLARIANT

Right: Addressing the needs of compounders working with PBT in EV platforms: Sebastian Hoerold, Senior Expert Flame Retardants at Clariant

significantly higher temperatures in battery modules, busbars, connectors, and power electronics, while traditional halogenated flame-retardant systems are giving way to halogen-free alternatives that satisfy environmental regulations without compromising performance. Compounders are also investing heavily in phosphorus-based, mineral-filled and synergistic additive technologies capable of dissipating heat while maintaining dielectric performance. Beyond flame retardancy, the emphasis has shifted towards multifunctional compounds combining high dielectric strength, thermal conductivity, low smoke generation, chemical resistance, long-term hydrolytic stability, and mechanical durability. This integrated approach allows a single material to address multiple engineering requirements while simplifying component design.

Thermal Shock

"Thermal shock is an important issue because modern EVs operate across a wider temperature range," said Arthur Rieb, Business Development Manager e-Powertrain, **Envalior**. "Components may experience rapid transitions from very low ambient temperatures to high operating temperatures generated by fast charging, regenerative braking, or high-power driving conditions. The combination of repeated thermal cycling and increasingly compact designs places greater demands on materials."

Xytron M5080ET was developed by Envalior to address these challenges. Rieb said key features include its thermal expansion behaviour, which is significantly closer to that of copper compared with conventional solutions, and its ductility, which means the material has a higher elongation at break.

"By reducing the mismatch between the copper conductor and the overmoulded polymer, internal stresses are minimised, helping reduce stress cracking during thermal shock events," he said. "Testing has demonstrated more than 70% higher thermal shock stress crack resistance compared with comparable PPS compounds."

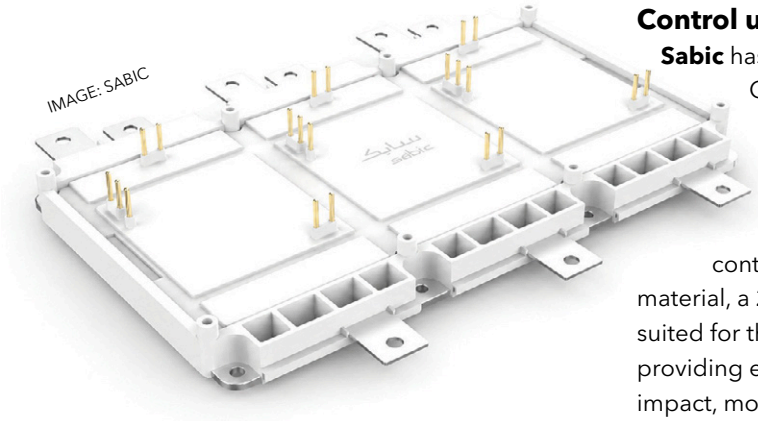
At The Battery Show North America, in Detroit last October, Envalior debuted Pocan BFN4232ZHR S1, a hydrolysis-stabilised, flame-retardant PBT which helps prevent silver migration and electrical stress, two major causes of breakdowns and arcing in high-voltage environments. The company also showcased the first fully functional high-voltage battery enclosure made entirely of engineered plastics, developed from Durethan B24CMH2.0 + 45% LGF PA6 and Tepex Dynalite 102-RGUD600 thermoplastic composite sheet technology which achieves lower weight, cost, and carbon footprint, compared to traditional metal housings.

Flame retardancy

In the field of additives, **Clariant** has expanded its Exolit OP portfolio with two new PBT flame retardants (FR), each targeting a specific engineering challenge. The first, Exolit OP 1242 (TP), addresses hydrolysis stability, an important property in automotive environments where components are exposed to moisture, humidity, and temperature fluctuations over long service lifetimes. Not all FR systems maintain their performance under these conditions and certain synergist combinations commonly used with phosphinate-based flame retardants can reduce hydrolytic stability.

The other new Clariant FR product, Exolit OP 1266 (TP), targets tracking resistance, providing a stable comparative tracking index (CTI) of 600 V in PBT compounds, even after extended storage periods. Both products achieve UL 94 V-0 classification at sample thicknesses as low as 0.4 mm, at dosing levels of 15–20% which supports EV manufacturers looking to reduce component weight and size.

Beyond their technical performance, both new offerings are halogen-free alternatives to traditional brominated FR products combined with antimony trioxide (ATO), which has seen significant price increases and supply chain volatility in recent years. OEM requirements around material composition are also tightening, and a halogen-free, ATO-free, PTFE-free approach helps manufacturers address this trend. Further development is targeting long-chain PA materials like PA 12 where the



Left: Sabic says its new series of LNP thermocomp compounds are well suited for high-power, high-voltage applications

challenge is to achieve V-0 while maintaining excellent impact properties.

In direct response to growing demand for flame retardants in Asia, Clariant has completed a $123.87m investment at its Daya Bay facility in China, with a second production line operational since November 2025. "For compound manufacturers working with PBT in EV platforms, the combination of hydrolysis resistance, stable CTI at 600 V, thin-wall V-0 capability, and a cleaner raw material profile represents a practical response to where vehicle electrical systems are heading," said Sebastian Hoerold, Senior Expert Flame Retardants at Clariant.

Control units

Sabic has introduced LNP Thermocomp WF-C061I compound featuring non-brominated/non-chlorinated flame retardance that can help enhance the safety and functionality of critical components, such as electric vehicle control units (EVCUs). This new specialty material, a 2025 Edison Award winner, is well suited for the housing of these applications, providing excellent protection from fire/smoke, impact, moisture, and other threats. Other advantages include colourability, low warpage, and high optical transmission for precision laser welding.

"The EVCU, which manages an EV's electrical systems to ensure peak efficiency and a safe driving environment, relies on high-performance materials," said Jenny Wang, Director, Formulation & Application, APAC, Sabic Polymers, Specialties business. "Based on our broad understanding of automotive power engineering trends and requirements, Sabic developed its new LNP Thermocomp WFC061I compound to help protect the EVCU and optimise its reliability and functionality."

At the most recent Battery Show Europe in Stuttgart, Germany, the company highlighted its

newly launched LNP Thermocomp OFM compounds, based on PPS resin, which broaden the scope of Sabic's offering and address increasingly rigorous voltage and power demands. Illustrating its extensive product scope, the company displayed a full-size replica of an EV battery pack, as well as individual battery components including a lightweight honeycomb energy absorber using Noryl GTX resin, a cell retainer and module frame made with LNP Konduit compound, and electrical insulation film extruded from Noryl NHP resin.

"Our customers are under pressure to deliver EV systems that handle more power, run cooler, and operate more reliably," said Sergi Monros, Vice President, Sabic's Specialties BU.

Sustainable expectations

Tisan Engineering Plastics formulates thermally conductive polymers and produces compounds under the Tislamid trademark. Tislamid 66, reinforced with glass fibre and special filler, offers more than 5 W/mK through/plane thermal conductivity as well as advanced flame resistance and maximum glow wire performance, while another grade of Tislamid 6 with special filler has 5.5 W/mK through/plane thermal conductivity, improved mechanical properties, and high strength. Another polymer under the Tisoplen trademark offers 0.95 W/mK through/plane thermal conductivity as well as electrical insulative properties. Tisan's product portfolio also includes PC-based polymers, such as grades under the Tisarbon trademark, which have similar enhanced properties.

Circularity is rapidly becoming a commercial requirement with OEMs increasingly expecting suppliers to reduce embedded carbon while incorporating recycled and renewable feedstocks wherever feasible. Tisan's EcoStar talc-filled recycled PP compound is designed for use in automotive applications, while its EcoStar PA grade is produced from high quality post-industrial recycled PA 66 materials. The most important feature of EcoStar products is that they can be customised to offer ecological and economical solutions in different markets.

The upcoming European End-of-Life Vehicles Regulation (ELVR) is bringing greater focus to circularity. "For material selection, this marks a fundamental shift," explains Kurt Maschke, Senior Director Global Business Development Automotive at **Mocom**. "Mechanical properties will no longer be the only deciding factor. A material's ability to be efficiently returned to the material cycle at the end of its service life will become equally important. At Mocom, we believe the greatest opportunity lies in addressing electrification and circularity together. Our portfolio therefore includes innovative PP, PA, TPV and high-performance polymer solutions as well as materials designed with future ELVR requirements in mind."

Recycled content

One example is the Altech PA FR product family which combine strong mechanical performance with halogen-free and PFAS-free flame retardant technology. Altech PA ECO FR solutions contain up to 35% recycled content while reducing CO_2 emissions by as much as 65% compared with equivalent virgin-material solutions demonstrating that sustainability and technical performance do not have to be at odds. "We evaluate the integration of PCR in every new product development," said Maschke. "Based on current experience, we see PCR shares of 20 to 30% as a realistic and technically sound future standard for many applications. Close cooperation between OEMs, system suppliers, raw material producers, and compounders, will be essential to meet both the technical demands of electrification and the requirements of the ELVR."

Eurotec continues to develop versatile solutions by combining sustainability with cost optimisation. Its Tecomid ECO product series not only meets the high-performance expectations of the industry, but also contributes to more economical and environmentally friendly production processes. For example, Tecomid ECO NB43 GR30 BK012 HS M65I contains 65% post-industrial recycled PA6 and 30% glass fibre reinforcement, offering high strength and impact resistance. With a lower carbon footprint, the material minimises environmental impact while providing a cost advantage, making it suitable for a wide range of automotive applications including sunroof frames, door handles, and electrical parts. Elsewhere, Tecomid ECO NB43 GR15 BK321 HS M50I contains 50% post-industrial recycled PA6 and 15% glass fibre reinforcement whilst offering excellent surface quality.

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