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Vol. 27, Issue 4 • October - November 2026 • Rs 75



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Innovation
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TURNING GRAPHENE INTO INDUSTRY

Ankur Khaitan, Managing Director and CEO of TACC Limited, on taking graphene from development to commercial use, building a 20,000-tonne anode material plant, and strengthening India's advanced carbon capabilities

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Volume 27 Issue 4 October - November 2026

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A TIME OF NEW OPPORTUNITIES

The way we make cars is changing. Electric vehicles are becoming more common, manufacturers are looking for lighter materials, and there is a growing focus on recycling. All this brings new opportunities for the plastics industry. But it also means we have to keep learning, adapting and finding better ways to work.

Our cover story in this issue looks at one such area of change. We speak to Ankur Khaitan, Managing Director and CEO of TACC Limited, about the company's work in graphene and advanced carbon materials. Graphene has the potential to be used in many areas, from construction and coatings to energy storage. TACC is also preparing to manufacture synthetic graphite anode material in India. Its planned plant, with a capacity of 20,000 tonnes a year, is an important step towards building domestic capabilities in this field.

What I found interesting in the conversation is the focus on taking research to the market. A new material may have great potential, but it must also offer the right quality, performance and cost. Only then will customers use it on a larger scale. This is something every company working on new materials needs to keep in mind.

The same is true of the automotive industry. Plastics are already used in many parts of a vehicle, including interiors, exteriors, electrical systems and under-the-hood components. As vehicles become lighter and more advanced, the role of polymers will only grow.

Electric vehicles are creating further opportunities. According to the International Energy Agency, more than 20 million electric cars were sold across the world in 2025. That is one in every four new cars sold. This growth is opening up new areas for plastics in battery systems, insulation, charging equipment and lightweight components.

India is also seeing strong growth. The country's automotive component industry recorded a turnover of Rs. 7.6 lakh crore in FY2025-26, according to ACMA, registering a growth of 12.7%. This creates opportunities for Indian manufacturers and suppliers across the automotive value chain.

There is also a clear push towards recycling. New European Union rules will require new vehicle types to use at least 15% recycled plastic from 2032, with the target rising to 25% in 2036. This shows how important recycled materials and better product design will become in the years ahead.

It is in this changing environment that we are organising the 10th edition Global Conference of Plastics in Automotive (GCPA) in Pune. We want to bring the automotive and plastics industries together, encourage open discussions and create opportunities to learn from one another.

The challenges are many, but so are the opportunities. We hope GCPA will help the industry share ideas, build partnerships and find practical solutions for the future.

We look forward to meeting you there.



Amit Shanbaug
Editor.



Photography: Vaibhav Nadgaonkar

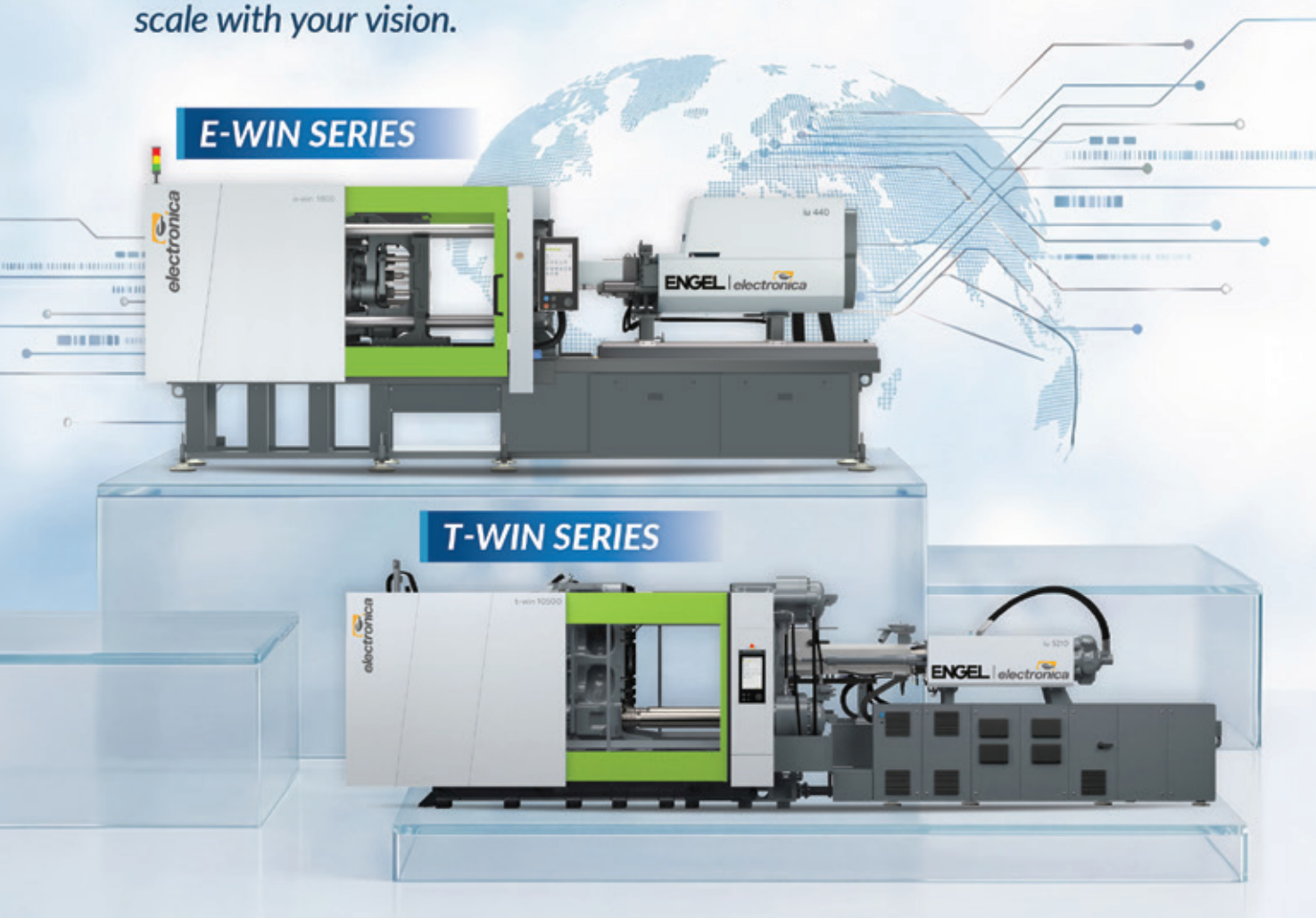
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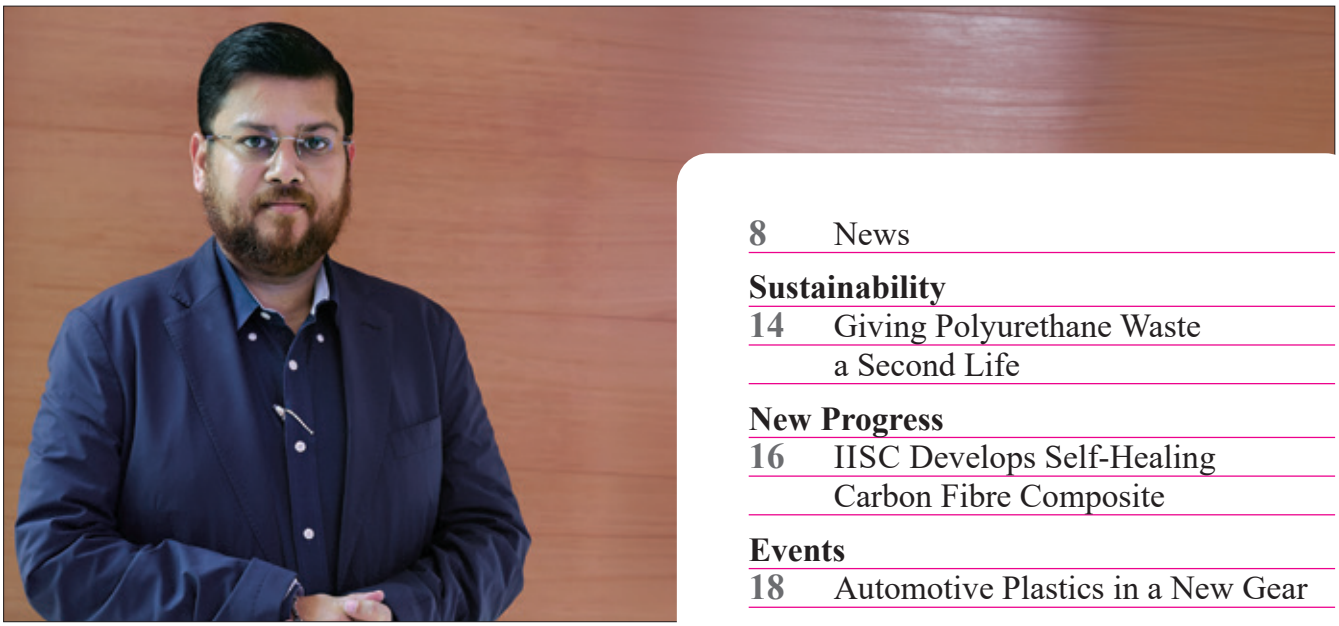


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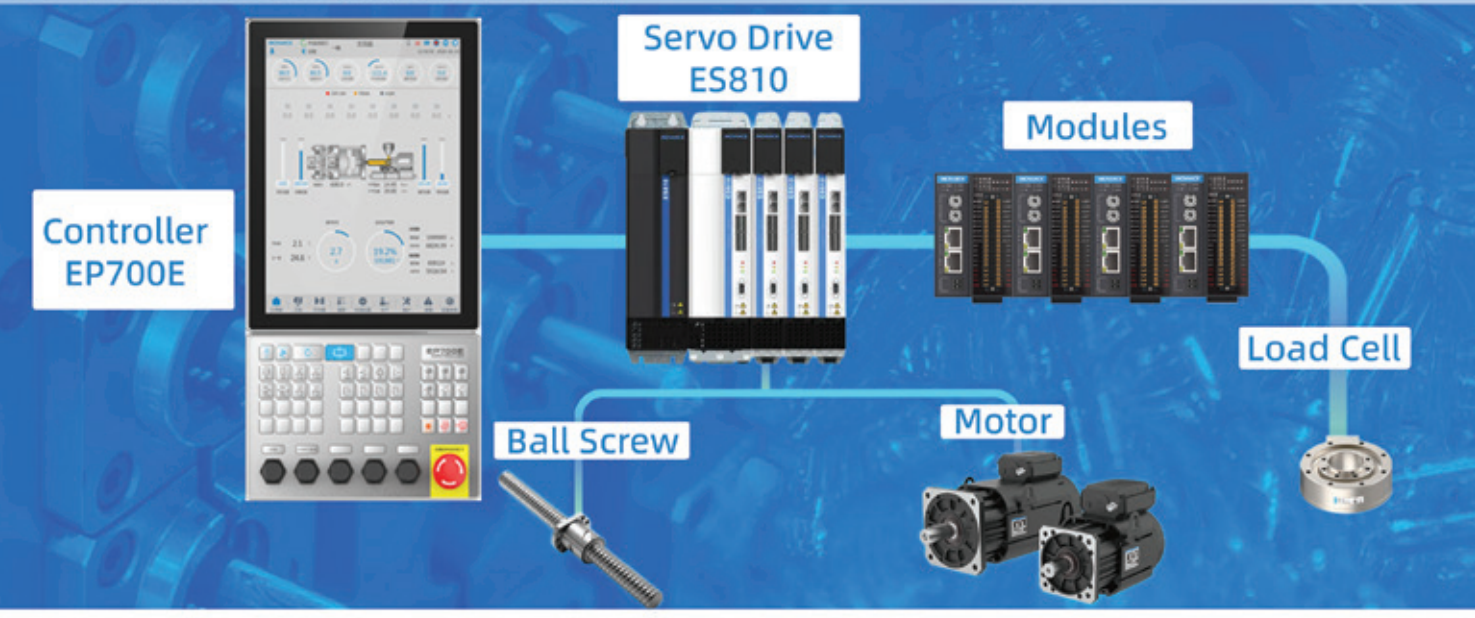
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IndianOil plans 5 lakh tonne polypropylene plant

The new plant at Koyali will add 500,000 tonnes of annual polypropylene capacity, helping IndianOil meet domestic demand and reduce imports.

By Team ET Now Polymers

IndianOil's Gujarat refinery at **Koyali, near Vadodara,** is expected to start producing polypropylene (PP) by the end of the 2026-27 financial year. The proposed plant will have an **annual capacity of 500,000 tonnes** and is part of a wider expansion of the refinery.



The project is expected to strengthen domestic polypropylene supplies at a time when demand for the polymer continues to grow. However, the additional capacity may not be enough to meet India's entire requirement, and imports are expected to continue.

The polypropylene unit will use propylene produced through IndianOil's in-house INDMAX technology. The project is part of the company's plan to expand the crude processing capacity of its Koyali refinery from 13.7 million tonnes per year to 18 million tonnes per year. The company expects to achieve the expanded capacity by the end of FY2026-27.

Turning refinery output into plastics

Polypropylene is one of the most widely used plastics. It is used to make packaging materials, woven sacks, household products, automotive components, appliances and several industrial products. It is also used in applications where strength, light weight and resistance to chemicals are important.

For plastic processors, a steady supply of polypropylene is essential for meeting customer orders and managing production costs. Any increase in domestic availability could give manufacturers another source of raw material and reduce their dependence on overseas suppliers.

The Koyali project is also significant because it will allow IndianOil to make greater use of its existing refinery operations. Its INDMAX unit is designed to produce more propylene, a key raw material used to manufacture polypropylene.

According to the company, the technology can deliver a propylene yield of around 18% of feed, compared with approximately 6% to 10% from a conventional fluid catalytic cracking unit. This will help direct more refinery output towards petrochemicals rather than fuels.

Imports will continue

Despite the addition of new capacity, India is expected to remain a net importer of polypropylene. Growing demand from packaging, automotive, consumer goods and other industries will continue to create a need for additional supplies.

Domestic production also needs to match the grades and specifications required by different industries. Import requirements can therefore continue even as local manufacturing capacity increases.

The new plant could help reduce the gap between domestic demand and supply. However, its actual impact will depend on when production begins, how quickly the unit reaches its planned capacity and how demand grows in the coming years.

A wider shift towards petrochemicals

The polypropylene plant is part of IndianOil's broader effort to increase the share of higher-value products in its business. The Koyali expansion also includes facilities for producing lube oil base stocks, which are used in the manufacture of lubricants.

For India's plastics industry, the project adds to domestic production capacity and strengthens the link between refining and polymer manufacturing. It could improve the availability of raw materials for processors, although the benefits will depend on production levels and market conditions.

With commissioning targeted for the end of FY2026-27, the focus will now be on completing the project and starting commercial production. The additional capacity is expected to support India's growing demand for polypropylene, even as the country continues to rely on imports to meet part of its needs.

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India's Plastics Exports Show Strong Growth

India's plastics exports are showing positive growth, with plastic raw materials and films among the key contributors.

By Team ET Now Polymers



India's plastics exports have recorded encouraging growth, pointing to stronger demand for Indian products in overseas markets.

According to figures released by the Ministry of Commerce and Industry on October 15, exports under the combined 'Plastic and Linoleum' category grew by 24.81% in September 2026 compared with the same month last year. The category recorded exports of around $869.69 million during the month.

India's overall merchandise exports also increased during this period. They rose to $44.40 billion in September 2026, compared with $36.08 billion in September 2025.

The longer-term figures are also positive for the plastics industry. According to data from the Department of Commerce, India's plastics exports reached $12.46 billion in the financial year 2025-26.

The growth has continued into the current financial year. Between April and July 2026, plastics exports increased by 17.4% to $4.997 billion. During the same period last year, exports stood at $4.257 billion.

Several product categories have contributed to this growth. Exports of plastic raw materials increased by 21.5% to around $1.27 billion during April-July 2026. Plastic films and sheets performed even better, recording growth of 36.4% and reaching $885 million.

Exports of flexible intermediate bulk containers (FIBCs), woven sacks, woven fabrics and tarpaulins also remained an important part of the export basket, with shipments worth around $590.7 million.

These figures show that Indian manufacturers are supplying a wide range of products to international markets. These include raw materials, packaging products, films, sheets and industrial applications. Indian plastic products are exported to more than 200 countries.

However, the industry will need to address a few challenges to maintain this growth. Competition from other manufacturing countries remains strong. Changes in raw material prices, shipping costs and international trade rules can also affect exporters.

There is another important factor. Buyers in many markets are paying greater attention to the environmental impact of plastic products. They are looking for better quality, recyclable materials and packaging that uses resources more efficiently.

This creates an opportunity for Indian manufacturers to invest in new products, better technology and improved recycling systems. Companies that can meet international quality and sustainability requirements will be in a stronger position to compete.

The latest export figures are a positive sign for the Indian plastics industry. The next step is to build on this growth by improving product quality, expanding into new markets and developing products that meet changing global requirements.

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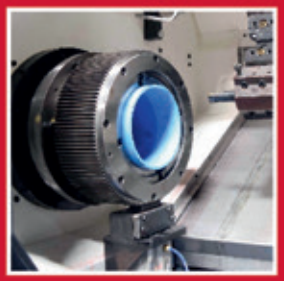
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Dragon Fruit Waste Could Help Make Smarter Food Packaging

Researchers have developed a biodegradable film that changes colour as shrimp loses freshness. The technology could offer a new way to monitor food quality while making use of fruit waste.

By Team ET Now Polymers

What if food packaging could tell us when the food inside is beginning to spoil? Researchers in India have developed a new film that does just that. Made using natural colour extracted from dragon fruit peel, the film changes colour in response to changes linked to food spoilage.

The study focuses on developing intelligent packaging that can help monitor the freshness of shrimp during storage.

Dragon fruit is known for its bright colour, but its peel is often discarded after the fruit is processed or consumed. The peel contains natural pigments called betalains. These pigments respond to changes in acidity and alkalinity, making them useful for developing colour-changing indicators.

The researchers used this property to create a freshness-monitoring film. They first extracted the pigment from dragon fruit peel and used an ultrasound-assisted process to encapsulate it with maltodextrin. This step was important because natural pigments can lose their colour and effectiveness over time.

The encapsulated extract was then added to a film made using modified elephant foot yam starch and polyvinyl alcohol (PVA). The researchers studied how the material behaved and tested its ability to respond to changes associated with shrimp spoilage.

As shrimp loses freshness, certain compounds are released. These cause changes in the food's chemical properties, including its pH and levels of volatile basic nitrogen. The natural pigment in the film responds to these changes by altering its colour.

The study found that the colour changes were closely linked to established measures of shrimp freshness. These included total volatile basic nitrogen, pH and other quality indicators. The researchers tested the film under both room-temperature and refrigerated storage conditions.

The addition of encapsulated dragon fruit extract also improved some properties of the film, including its antioxidant activity and mechanical characteristics. This suggests that fruit-processing waste could have value beyond conventional uses such as animal feed or disposal.

The development is part of a growing interest in intelligent food packaging. Unlike ordinary packaging, which mainly protects food from outside conditions, intelligent packaging can also provide information about the condition of the food. A visible colour change could help consumers, retailers and food suppliers identify possible spoilage without having to open the pack.

However, the technology is still at the research stage. More work will be needed to establish its performance in commercial packaging, its shelf life, production cost and suitability for different food products. The film also contains PVA, so it is not an entirely natural-material alternative.

Even so, the research points to an interesting direction for the packaging industry. It brings together food waste, natural pigments and polymer technology to create packaging that does more than simply wrap a product. If further developed, such films could help improve food-quality monitoring and reduce avoidable food waste.

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GIVING POLYURETHANE WASTE A SECOND LIFE

A new recycling facility in Kerala aims to turn footwear manufacturing waste into useful products, create local jobs and keep plastics out of landfills.

By Team ET Now Polymers

Polyurethane (PU) is used in many everyday products, from footwear and furniture to mattresses and automotive components. Yet, finding a suitable way to manage the waste generated from these products remains a challenge. A new facility in **Manjeri, Kerala,** aims to address part of this problem by giving polyurethane waste from the footwear industry a second life.

BASF India, Green Worms and the Indian Polyurethane Association (IPUA) inaugurated the facility on October 14, 2026. Supported by BASF India's corporate social responsibility (CSR) programme, the initiative will focus on collecting, sorting and mechanically recycling post-industrial polyurethane waste generated during footwear manufacturing.

The idea is straightforward. Instead of sending the waste to landfills, the partners want to recover the material and turn it into useful products. One of the planned applications is indoor floor mats for rural schools in Kerala. The first phase is expected to benefit around 4,000 schoolchildren while also creating livelihood opportunities for waste collectors and recycling workers.

Tackling a difficult waste stream

Unlike conventional packaging plastics, polyurethane waste presents its own recycling challenges. The material is widely used because of its useful properties, including cushioning, flexibility and durability. However, different types of polyurethane behave differently during recycling, making the choice of process important.

Mechanical recycling offers one way to recover suitable waste. The material is processed physically rather than broken down into its original chemical building blocks. Depending on its composition and the recycling process used, the recovered material can be incorporated into new products.

The Kerala initiative focuses on waste generated during footwear production rather than discarded shoes collected after use. This is an important distinction. Manufacturing waste can be easier to collect and sort because its source is known and the material is generally more consistent. Used footwear, on the other hand, may contain several materials, including rubber, textiles, adhesives and different plastics, which can make recycling more complicated.

By setting up a collection and segregation network alongside the recycling facility, the partners aim to create a more organised route for handling this waste.

Can the model be expanded?

The project also highlights the role that partnerships can play in improving industrial waste management. BASF India is leading the CSR initiative, Green Worms is responsible for implementation, and IPUA is providing industry support.

For the model to grow, however, the availability of waste will be as important as the recycling technology itself. Manufacturers need a reliable way to send their waste for processing, while recyclers need a steady supply of suitable material and buyers for the products they make.

The economics will also matter. The cost of collection, transportation, sorting and processing must be balanced against the value of the recycled material and the demand for finished products.

BASF India has not disclosed the facility's processing capacity, the investment involved or the quantity of polyurethane waste it expects to recover. These details will be important in assessing the project's potential for expansion.

For now, the Manjeri facility offers a practical example of how an industry can begin addressing a waste stream that receives less attention than plastic bottles and packaging. Its success will depend on whether the collection network can be sustained, the recycled material can find regular buyers and the model can be extended to other applications.

If these conditions are met, the initiative could encourage more manufacturers to look at their production waste not simply as a disposal problem, but as a material that can be put to further use.

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IISC DEVELOPS SELF-HEALING CARBON FIBRE COMPOSITE

The new material combines higher strength, self-healing properties and recycling potential, opening up possibilities for advanced aerospace and other demanding applications.

By Team ET Now Polymers

Researchers at the **Indian Institute of Science (IISc), Bengaluru,** have developed a carbon fibre composite that can repair some impact damage and be recycled while retaining much of its mechanical strength. The material also offers improved strength and additional functions that could make it useful for advanced engineering applications.

The research, addresses a major challenge in the use of carbon fibre reinforced epoxy composites. These materials are widely used in aerospace and marine applications because they are strong, stiff and lightweight. However, conventional epoxy composites are difficult to repair when damaged and challenging to recycle at the end of their service life.

The IISc team developed a new composite using a special epoxy called a vitrimer, combined with modified carbon fibres and graphene oxide. Vitrimers contain chemical bonds that can rearrange under suitable conditions, allowing the material to be repaired and recycled in ways that conventional epoxy systems generally cannot.

The results showed a **53% increase in flexural strength and a 47% improvement in interlaminar shear strength** compared with conventional carbon fibre reinforced epoxy composites. Flexural strength measures a material's ability to withstand bending, while interlaminar shear strength indicates how well its layers resist sliding against each other.

The researchers also demonstrated a **self-healing efficiency of 64% after impact damage.** This means the material recovered a significant part of its measured performance after damage, rather than returning completely to its original condition.



Recycling was another important part of the study. The researchers recovered the epoxy material and carbon fibres and used them to produce new composite laminates. The recovered epoxy retained 92% of its original interlaminar shear strength, while the recovered carbon fibre retained 96%. When both recovered materials were combined to make new composite laminates, the resulting material retained 85% of the original interlaminar shear strength.

The approach could help reduce waste from high-performance composite components and improve the use of valuable carbon fibres. Instead of treating a damaged or discarded component as waste, manufacturers could potentially recover its constituent materials for use in new products.

The composite also demonstrated other useful properties. It provided electromagnetic interference shielding of -46 dB, which could help protect sensitive electronic systems from unwanted electromagnetic signals. The material also demonstrated de-icing in 47 seconds under the reported test conditions. These features could be relevant to applications where electrical protection and ice removal are important.

The findings are promising for aerospace and other advanced engineering sectors, where manufacturers need materials that combine low weight, strength, durability and better end-of-life options. However, the results are based on research and do not establish that the material is ready for use in certified aircraft structures. Further testing, process development and industrial validation would be needed before commercial adoption.

The study offers a possible route towards making carbon fibre composites more durable and easier to recover at the end of their useful life. By combining improved mechanical performance with self-healing and recycling capabilities, the IISc research addresses two important industry needs: extending the useful life of advanced materials and reducing waste.

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AUTOMOTIVE PLASTICS IN A NEW GEAR

The 10th edition of the ET NOW Polymers Global Conference on Plastics in Automotive is scheduled to be held on 26th November, 2026 in Novotel, Viman Nagar, Pune.

By Team ET Now Polymers

The automotive industry is entering a period of significant transformation, with electrification, lightweighting, and sustainability redefining vehicle design and manufacturing. At the centre of this transition is the growing role of plastics, which are enabling manufacturers to rethink vehicle architecture, improve component performance and develop more resource-efficient mobility solutions.

Against this backdrop, this year's ET Now Polymers Global Conference on Plastics in Automotive is centred on the theme **'Smart Materials, Sustainable Mobility'.** Marking a decade, this conference will bring together industry experts, automotive original equipment manufacturers (OEMs), Tier 1 and Tier 2 suppliers, polymer manufacturers, machinery providers, to examine the evolving relationship between materials innovation and automotive manufacturing.

Amidst the growing adoption of electric vehicles, material requirements are becoming increasingly specialised. Lightweighting, heat management, electrical insulation and battery safety are emerging as crucial considerations for automotive manufacturers. At the same time, conventional vehicle applications continue to demand materials that offer durability and design flexibility.

This conference is expected to examine how advanced polymers, engineering plastics and innovative processing technologies can address these requirements. Discussions will also focus on manufacturing efficiency, material validation, localisation and the growing need for closer collaboration between OEMs and other stakeholders.

Circularity will remain another important area of industry interest. The integration of recycled polymers, improved material recovery and designing components for recyclability present opportunities as well as technical challenges. Addressing these will require coordinated efforts across material development, component design and manufacturing.

For OEMs, the conference offers an opportunity to exchange perspectives on material innovation, vehicle performance and future sourcing requirements. Component manufacturers can explore emerging technologies, strengthen industry connections and understand evolving customer expectations. Polymer producers and machinery providers can engage with automotive decision-makers, identify application opportunities and build potential partnerships. The platform also enables recyclers and sustainability stakeholders to engage with the automotive value chain on practical circularity solutions.

The conference will be supported by **Milacron India Pvt Ltd** as Presenting Partner, **Covestro (India) Pvt Ltd** as Platinum Partner, **Yizumi Advanced Processing Technology Pvt Ltd** and **Trinseo India Trading Private Limited** as Gold Partners, and **ITIB Machinery India Corrugators** as Silver Partner and **Yudo Hot Runner India Pvt Ltd** as the Supporting Partner.

This year, the conference aims to strengthen dialogue between the automotive and plastics industries, encouraging a more sustainable mobility ecosystem in India.

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EPR COMPLIANCE PUTS PLASTIC INDUSTRY UNDER PRESSURE

With annual returns due by October and December 2026, India's plastic packaging industry faces tighter scrutiny of recycling records, registration and recycled content.

By Team ET Now Polymers

India's plastic packaging industry is entering an important phase as companies prepare to meet their Extended Producer Responsibility (EPR) obligations for the financial year 2025-26. With the annual return filing window reopening on a new government portal and revised deadlines being reported, producers, importers, brand owners and recyclers need to check their records and ensure that their compliance is in order.

The immediate concern is the annual return filing process. According to a regulatory advisory published in September 2026, the revised deadline for registered plastic waste processors is **31 October 2026,** while producers, importers and brand owners have until **31 December 2026** to file their returns for FY2025-26.

The deadlines follow a change in the government's online reporting system. The Central Pollution Control Board (CPCB) discontinued its earlier Plastic EPR Portal on 28 June 2026 and moved the data of registered units to a new Common EPR Portal. The earlier portal now allows users to check historical data and verify whether it has been transferred correctly.

The transition affected the annual return filing process. Companies need to access the new portal, verify their migrated information and resolve discrepancies before submitting their returns.

What companies need to report

EPR is a key part of India's Plastic

Waste Management Rules, 2016. It places responsibility on producers, importers and brand owners to ensure that the plastic packaging they introduce into the market is managed through the prescribed waste collection, recycling and disposal systems.

The annual return is an important part of this process. Companies must report relevant packaging quantities, their fulfilment of EPR obligations and the use of recycled plastic, wherever applicable. Plastic waste processors must also maintain and report records of the waste they handle.

For companies, this means that compliance cannot be limited to filing a form before the deadline. The information submitted must match their actual business operations and supporting records.

Registration is another important requirement. Companies should check the registration status of the entities with which they conduct transactions and verify that the relevant recycling and EPR certificate records are accurate. The CPCB's portal transition makes it particularly important to reconcile old records with the information available on the new system.

Recycled plastic targets add to the pressure

The compliance challenge extends beyond annual returns. India's EPR framework also prescribes minimum recycled plastic content in different categories of plastic packaging.

For FY2025-26, the prescribed recycled plastic content targets are 30% for Category I (rigid plastic packaging), 10% for Category II (flexible plastic packaging) and 5% for Category III (multilayered plastic packaging).

The targets are scheduled to increase for some categories in the coming years. For FY2026-27, the prescribed recycled content requirements are 40% for Category I, 10% for Category II and 5% for Category III.

The rules also provide for exemptions in specified circumstances where the use of recycled plastic is not permitted under applicable laws or statutory requirements. Companies claiming an exemption must meet the relevant conditions and provide the required supporting information.

These requirements make the availability and quality of recycled plastic an important issue for the packaging industry. Manufacturers and brand owners need to consider not only the quantity of recycled material they use but also whether the material meets the requirements applicable to their products.

A closer link between brands and recyclers

The growing focus on compliance is likely to bring packaging companies and recyclers into closer contact.

Brand owners need reliable information about the packaging they use, and the recycled material incorporated into it. Producers and importers must understand their category-wise obligations, while recyclers need to maintain accurate records of the waste they process and the certificates they issue.

Any mismatch between reported quantities, recycling records and supporting documents can create problems during compliance checks. Companies therefore need stronger coordination between procurement, packaging, sustainability, finance and regulatory teams.

For smaller packaging converters and recyclers, maintaining records and keeping registrations up to date can also require additional time and resources. Those dealing with several customers may need to pay particular attention to documentation and the accuracy of transactions.

At the same time, a system that improves the tracking of plastic waste and recycling certificates could help build greater confidence in the recycling chain. Better records can make it easier for companies to establish whether their obligations are being met and identify gaps that need attention.

The business impact

For the plastics industry, EPR compliance has implications beyond environmental reporting.

The need to meet recycled content targets can influence raw material sourcing, packaging design and discussions between converters and brand owners. Companies may need to reassess their suppliers, check the availability of suitable recycled material and account for any additional costs involved in meeting their obligations.

The impact will not be the same for every business. It will depend on the type of packaging, the scale of operations, the applicable targets and the availability of recycled material that meets the required specifications.

The rules also make it important for businesses to distinguish between recycling plastic waste and using recycled plastic in new packaging. These are related but separate requirements, and meeting one does not automatically mean that all other EPR obligations have been met.

For companies, the immediate priority is to verify their registration and records, reconcile their data on the Common EPR Portal and prepare their annual returns within the applicable timelines.

India's plastic packaging industry has been working towards greater recycling and more responsible waste management for several years. The current compliance phase puts the focus on how effectively these requirements are being translated into business practices.

The coming months will test the industry's ability to maintain accurate records, secure suitable recycled material and meet its obligations. For manufacturers, converters, recyclers and brand owners, getting these basics right will be essential to managing both regulatory requirements and the commercial demands of a changing packaging market.



PACKAGING'S SHIFT TOWARDS SMARTER MINIMALISM

Rising consumer expectations, regulatory pressure, and material innovation are pushing the packaging industry to rethink circularity and performance across the value chain.

By Pratiksha Marathe

Packaging has long been judged by how effectively it protects a product, and attracts consumers. Today, those expectations are expanding. Brands are also considering how much material a package uses, whether it can be recycled in practice, and what happens when it reaches the end of its life.

The challenge is no longer simply to make packaging lighter or replace plastic with another material. It is to rethink packaging from the ground up.

The shift is already visible in consumer preferences. According recent industry report, 61% of American consumers identified minimal packaging as the feature they value most in sustainable brands. For manufacturers, the message is becoming difficult to ignore.

The case for doing more with less

Minimalism is moving beyond aesthetics to become a priority. Rising material costs, logistics efficiency and regulatory requirements are encouraging companies to reduce packaging weight and reconsider package dimensions. Businesses are already exploring practical ways to achieve these reductions.

Redesigning product packs to fit more units into a shipment can improve pallet utilisation and transport efficiency. Lightweight structures and stronger materials can also reduce material consumption

without sacrificing durability.

The global minimalist packaging market was is estimated to grow at a compound annual growth rate **(CAGR) of 6.7% from 2025 to 2034,** as per a recent market research report.

However, reducing packaging indiscriminately can create a different set of problems. A package that fails during transit can result in damaged goods, additional waste and higher costs. In food applications, inadequate protection can contribute to food waste, potentially undermining the environmental benefits of using less packaging.

Ron Sasine, Principal at Hudson Windsor and a packaging strategy and sustainability expert, argues that the industry needs to look beyond incremental reductions in plastic use.

"Real progress comes from determining which materials are truly needed and removing the unwanted materials altogether."

The distinction is important. Cutting a percentage of a material is not necessarily the same as questioning whether every component is required. The more meaningful approach is to identify the packaging needed for the product, its distribution conditions and its intended use, then eliminate what adds no essential value.

As Mikael Nygårds, Senior Specialist, Package Performance at Billerud, puts it, "The goal is not to use less material at any cost, but to use the right amount."

This principle of right weighting places performance alongside material reduction. Packaging must be evaluated across its entire journey, rather than judged only by its weight or appearance.

Materials matter, but context matters more

Fibre-based formats are gaining importance in applications traditionally dominated by fossil-based materials. Paperboard, corrugated packaging and moulded-fibre formats offer alternatives for selected dry foods, confectionery, personal care products, multipacks and shipping applications.

Innovation extends beyond conventional paper and plastic. Packaging developers are exploring agricultural residues, waste-derived inputs, seaweed-based films and bio-based coatings. Some approaches combine a fibre-based structure with a thin, separable barrier layer to provide the moisture or other protection a product requires.

Yet no single material can meet every packaging requirement. Performance, cost, manufacturing speed, shelf life and compatibility with existing production lines all influence whether an alternative can move beyond pilot projects into large-scale use.

> "Packaging innovation today is not about simply using less material or replacing plastic. The focus is on designing fit-for-purpose packaging that is recyclable and consumer convenient.

As Paul Jenkins, Founder and CEO of ThePackHub, observes, "The future of packaging is not about replacing one material with another. It is about building more diverse, adaptable, and scalable material systems."

Circularity, therefore, depends on more than material selection. It requires packaging to be designed around the waste-management systems and consumer behaviour of the markets in which it is sold.



Beyond sustainability to better design

Packaging is also expected to deliver a better consumer experience. Digital features are adding another dimension. QR codes can provide product information, sourcing details and recycling guidance, helping consumers make more informed decisions. The broader opportunity is to integrate these functions into packaging. Hence, the next phase of packaging innovation will depend on connecting design decisions with real-world outcomes:

- Material reduction must be balanced against product protection
- Alternative materials must prove their scalability
- Recyclability claims must reflect what happens after disposal

The industry's task is to make each package fit for purpose, using only what is necessary and ensuring that the materials, design and recovery systems work together. In that shift, minimalism becomes more than a design trend: it becomes a way to rethink the value packaging delivers.

TURNING GRAPHENE INTO INDUSTRY

Ankur Khaitan, Managing Director and CEO of TACC Limited, on taking graphene from development to commercial use, building a 20,000-tonne anode material plant and strengthening India's advanced carbon capabilities.



By Amit Shanbaug

India's advanced materials industry is at a stage where the challenge is no longer just developing new materials. The real test is making them consistently, at a competitive cost, and finding industrial applications that justify their use.

For TACC Limited, this is the opportunity it wants to pursue. The company is developing advanced carbon materials, including graphene and its derivatives, while preparing to enter the battery anode material market on a commercial scale.

For the polymers industry, TACC's work on graphene has particular relevance in areas such as coatings, protective systems and materials that need better electrical or thermal performance. These applications could open up opportunities for manufacturers looking to improve product performance, provided the material can meet their requirements at a commercially viable cost.

Ankur Khaitan, Managing Director and CEO of TACC Limited, believes that the future of advanced carbon materials will depend on how effectively companies



solve customer problems.

"Graphene is like a service and not a commodity business," is the way he describes the approach. The focus, he explains, is on understanding what customers need and developing materials that deliver measurable benefits.

Finding the right applications for graphene

Graphene has attracted considerable interest because of its properties. However, high costs and the difficulty of maintaining consistent quality have limited its wider adoption.

TACC has been working on different types of graphene for different applications. Khaitan identifies construction materials, coatings and protective systems, conductive and thermal materials, and energy storage as areas with commercial potential.

In construction, the company says it has been able to reduce cement requirements by 30% or more in certain applications while improving strength, reducing costs and offering a greener material. The results are encouraging, although the commercial opportunity will depend on the requirements of individual applications.

Coatings and protective systems offer another area of interest. Graphene can help improve corrosion resistance and barrier performance in industrial and marine coatings. Such properties are important for products that need to withstand demanding operating conditions.

> "India's advanced materials sector is shifting from innovation to commercialisation, with graphene emerging as a key opportunity. TACC Limited is developing graphene-based solutions for construction, coatings, energy storage and thermal management. Its focus is on delivering measurable customer benefits, and solving real-world industrial challenges.

The material's electrical and thermal conductivity also creates opportunities in electrical conductors, thermal interface materials and heat-spreading applications. In energy storage, graphene can be used as a conductive additive and in anode-related applications to improve overall performance.

For TACC, the next step is to move these developments towards wider industrial use. Khaitan says the company is encouraged by customer validations and acceptance but recognises that wider adoption will take time.

He expects broader commercial adoption of graphene to be two to three years away. The initial growth, in his view, will come from applications where the material can replace an existing cost or solve a specific problem, rather than from customers using it simply because it is a new material.

Consistency remains a major concern. Industrial customers need assurance that the material they qualify today will be available at the same quality a year later. This makes close cooperation with customers important, both during product development and after commercial supplies begin.

For manufacturers in the wider polymers value chain, this is an important consideration. The opportunity is not simply to use a new material, but to establish whether it can improve the performance, cost or durability of the finished product.



Building India's anode material capacity

While graphene is an important part of TACC's plans, its immediate manufacturing priority is synthetic graphite anode active material for lithium-ion batteries.

India is expanding its battery cell manufacturing capacity, but much of the material required for battery production continues to be imported. Khaitan estimates that anode material accounts for around 10-15% of a battery cell's cost, while India's dependence on imports for this material is close to 100%.

He also points to the concentration of global supply. More than 95% of anode material production is in China, according to the figures cited in his interview. This dependence creates a supply chain risk for India's growing battery industry.

TACC's response is a planned 20,000-tonne-per-annum anode active material plant at Sirsoda, near Dewas in Madhya Pradesh. The project is under full construction, with commercial operations targeted for 1 April 2027.

Civil work is largely complete across the process shops, structural work and pre-engineered buildings are progressing, and long-lead equipment has started arriving.

The immediate priorities are to put utilities in place, complete the graphitisation shop and begin trial production according to schedule. The company then plans to supply initial batches to customers from the commercial production line.

The plant's progress is important, but producing the material is only one part of the task. Battery manufacturers require close control over particle size distribution, tap density, specific surface area, first-cycle efficiency, capacity and impurity levels. Each batch must meet the customer's specifications consistently.

Khaitan says the manufacturing process involves several stages, from powder processing to graphitisation. The parameters at each stage influence the final electrochemical performance of the material.

Graphitisation is particularly important because it affects crystallinity, purity and cost. This is an area where TACC draws on the experience of its parent group, LNJ Bhilwara, and its associate company HEG.

Experience that can make a difference

HEG has operated graphite electrode plants at Mandideep for decades. Its experience includes running furnaces at temperatures of around 3,000°C and managing large-scale, high-temperature carbon processing.

Khaitan believes this background gives TACC an advantage in furnace design, energy management, coke behaviour and purity control. It also helps the company manage costs, since graphitisation is the largest single cost element in synthetic graphite anode production.

The group's manufacturing experience also provides credibility when dealing with global customers, who need confidence in a supplier's

technical capabilities and long-term commitment.

TACC has already established a pilot and demonstration facility at Mandideep, near Bhopal. The facility follows the same process chain planned for the Sirsoda plant and can produce tonnes of customer-grade material.

Material from Mandideep has been evaluated by cell manufacturers and original equipment manufacturers across the world. Each customer follows its own testing protocol, and the results have helped TACC refine its specifications.

Some evaluations have progressed to formal qualification and supply discussions. These are important steps towards commercial production, although the final outcome depends on completing customer qualification and meeting their requirements.

The demonstration facility has also helped prepare the workforce for larger operations. Production teams, quality engineers, laboratory staff and commercial personnel have gained experience in making and testing the material. Lessons in utilities, material handling, maintenance and production data management have also been incorporated into the commercial plant's design and operating systems.

Research that leads to revenue

TACC's plans extend beyond graphene and synthetic graphite anode materials. The company is also looking at silicon anodes and other advanced carbon materials.

Khaitan says the company's research and development approach is guided by a simple principle: research must eventually lead to revenue. This does not mean expecting every project to generate immediate returns. Rather, the company wants to balance long-term research with a clear plan for commercialisation.

Development follows a series of stages. It begins with laboratory proof of concept, moves to pilot production at kilogram scale and then to demonstration at tonne scale, where customers receive samples. A commercial plant is considered only after these stages have been completed successfully.

> "TACC is building India's advanced materials capabilities through domestic production of synthetic graphite anode materials and graphene-based solutions. Its upcoming 20,000 TPA anode plant aims to reduce import dependence, strengthen battery supply chains, and position India as a competitive global supplier.

Each stage has defined criteria for continuing or stopping a project. This allows the company to discontinue developments that do not work instead of continuing to invest in them indefinitely.

TACC also plans to work with external partners where suitable technologies or capabilities already exist. Licensing and joint development can help the company move faster, while its own research team focuses on areas that offer a clear competitive advantage.

Institutional partnerships and skilled people are central to this approach.

The road ahead

Over the next five years, TACC's first priority is to execute its plans in line with customer requirements. The company intends to begin with the planned 20,000-tonne anode material capacity at Dewas and expand further to serve Indian and international markets.

Its ambition is to become a leading non-Chinese supplier of anode materials to global customers.

For graphene and other advanced carbon materials, the company plans to focus on developing solutions in partnership with customers rather than treating the products as commodities. This approach will require continued work on quality, cost and reliable supply.

Khaitan believes India has several advantages, including engineering talent, its energy cost position and growing demand. However, important gaps remain in upstream materials, testing standards and policy support.

Government measures, including production-linked incentive benefits, are supporting the development of domestic manufacturing capabilities. Talent is also developing in material science, alongside the growth of battery cell manufacturing. Khaitan says the willingness of cell makers to work with domestic suppliers is another encouraging change.

He believes India will need manufacturing scale, competitive unit economics and consistent policies on duties, incentives and the status of critical materials to become a competitive global supplier.

Building advanced materials businesses takes time, particularly when products must pass demanding customer qualification processes. Companies must be prepared to invest through these years while maintaining technical discipline and commercial focus.

For TACC, the immediate task is to get its anode plant running on schedule while turning its graphene developments into dependable industrial products.

The larger opportunity is to build manufacturing capabilities that serve several advanced material markets from a common base of carbon processing and research. If the company can combine consistent quality, competitive costs and close customer partnerships, it could help strengthen India's position in a sector where global supply remains highly concentrated.



EUROPE'S NEW PACKAGING RULES PUT INDIAN EXPORTERS ON ALERT

The EU's new packaging regulation sets tighter rules on recycling, materials and waste, requiring Indian suppliers to prepare for changing customer demands.

By Team ET Now Polymers

The European Union's new **Packaging and Packaging Waste Regulation (PPWR)** came into effect on 12 August 2026, bringing major changes to the way packaging is made, used and recycled. The rules cover packaging placed on the EU market and will affect companies across the supply chain, including businesses that supply packaging and packaged products to Europe.

For Indian plastics manufacturers and exporters, the regulation is an important development. Companies selling to European customers may need to review the materials they use, the design of their packaging and the information they provide about their products. The changes will come into force in stages, giving businesses time to prepare for requirements that apply in the coming years.

The regulation aims to reduce packaging waste, improve recycling and encourage the use of recycled materials. It also replaces the earlier system of national packaging rules with a common framework across EU member countries.

Recycling takes centre stage

One of the main changes is the push to make packaging easier to recycle. Under the new rules, all packaging must meet recyclability requirements by 2030, with the detailed requirements and their application depending on the relevant provisions and implementation measures.

The regulation also sets targets

for the use of recycled plastic in packaging. These requirements will apply from 2030, with targets varying according to the type of packaging and its use.

For Indian manufacturers, this could mean greater demand for packaging that is easier to recycle and contains recycled material. Companies may also need better records of the materials used in their products to demonstrate compliance with customer and regulatory requirements.

The changes could create opportunities for businesses that can supply suitable recycled plastics and develop packaging that meets European requirements. However, manufacturers will need to assess the quality, availability and cost of these materials before making changes to their production processes.

Restrictions on certain packaging

The regulation also aims to reduce unnecessary packaging and limit the use of certain single-use formats. From 2030, restrictions will apply to specified types of single-use plastic packaging, while measures to reduce excessive packaging and empty space will also come into effect.

Another important change concerns PFAS, a group of chemicals used in some packaging to resist water and grease. These substances are often called 'forever chemicals' because they persist in the environment.

Since 12 August 2026, food-contact packaging containing PFAS at or above the specified limits cannot be placed on the EU market, subject to the regulation's provisions. This is an immediate requirement, unlike several of the measures scheduled for 2030.

What Indian companies need to do

Indian exporters should begin by identifying which products and packaging formats they supply to European customers. They should then check the relevant requirements, review material specifications and discuss compliance expectations with their buyers.

Companies may also need to strengthen documentation covering material composition, recycled content and recyclability. The exact obligations will depend on the product, the company's role in the supply chain and the provisions applicable to it. European importers and other businesses responsible for placing products on the market may have specific compliance duties.

The EU has published guidance to help businesses understand the regulation, although some technical details will depend on further implementation measures.

For India's plastics industry, the new rules are both a challenge and an opportunity. Companies that prepare early may be better placed to retain European customers and compete for new orders. Those that delay could face higher adjustment costs or find it harder to meet changing buyer requirements.

The key question is no longer just how much packaging a company can produce, but whether it can meet the standards its export markets demand.



INDIA'S POLYMER SUPPLY GAP MAY WIDEN TO 7.8 MILLION TONNES

India's polymer demand is projected to reach 22.1 million tonnes by FY2031, but domestic production may fall well short of requirements.

By Team ET Now Polymers



India's polymer industry is preparing for another phase of growth, but domestic production may struggle to keep pace with rising demand. A recent analysis estimates that the gap between consumption and domestic production of commodity polymers could increase from 3.4 million tonnes in FY2025 to 7.8 million tonnes by FY2031.

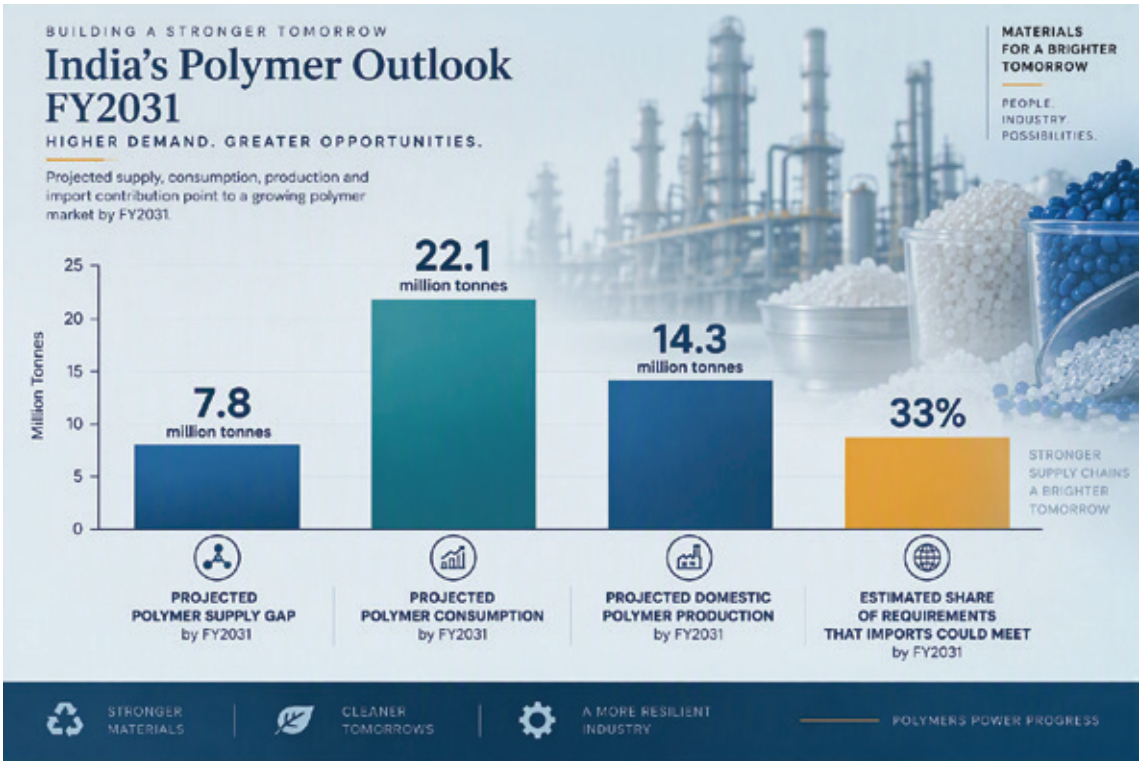
The analysis, published on October 8, 2026, says India's commodity polymer consumption could rise from 16.8 million tonnes in FY2025 to 22.1 million tonnes by FY2031. Domestic production, however, is projected to increase only from 13.4 million tonnes to 14.3 million tonnes during the same period.

If these projections hold, imports could account for around 33% of India's polymer requirements by FY2031. This would increase the industry's dependence on overseas suppliers, even as several companies plan to expand their domestic production capacity.

Demand is growing faster than production

Polymers are used in a wide range of products, including food packaging, pipes, electrical equipment, automobiles, household goods and industrial components. Demand from these sectors has increased over the years, creating a need for more raw materials.

The figures show that domestic production has also grown. India's commodity polymer output increased from 9.3 million tonnes



in FY2018 to 13.4 million tonnes in FY2025. However, consumption rose from 12.8 million tonnes to 16.8 million tonnes during the same period.

The gap has not increased every year. It narrowed when new capacity came on stream, but widened again when demand grew faster than domestic output.

The latest projections raise a concern for plastic processors. If local supply does not grow quickly enough, manufacturers may have to depend more on imported raw materials to meet their production needs.

New plants could change the picture

Several major projects are in the pipeline, which could improve domestic availability.

Bharat Petroleum Corporation Limited (BPCL) has awarded contracts for a new polypropylene unit with an annual capacity of 550,000 tonnes and a polyethylene complex with a capacity of 1.15 million tonnes at its Bina refinery in Madhya Pradesh.

Hindustan Petroleum Corporation Limited (HPCL) is also developing its refinery-cum-petrochemical complex at Barmer in Rajasthan. The project is planned to have petrochemical output of 2.4 million tonnes per year, including polypropylene and a polyethylene unit.

Meanwhile, GAIL commissioned a 60,000-tonne-per-year polypropylene unit at Pata in Uttar Pradesh in February 2026. These projects add to India's efforts to increase domestic polymer production.

However, the timing of these investments will be important. A project announced today cannot meet current demand until it is completed and begins commercial production.

BigMint also points out that the government's production projections do not fully account for several announced capacity additions. The projected supply gap should therefore be seen as a warning of what could happen if production does not increase fast enough, rather than a fixed outcome.

What it means for plastic processors

A larger supply gap could increase the importance of imports in the domestic market. For plastic processors, this makes the availability and cost of raw materials important factors in production planning.

Greater dependence on overseas suppliers can also expose buyers to changes in international prices, shipping costs and supply disruptions. At the same time, new domestic capacity could give processors more sourcing options once the plants become operational.

For polymer producers, the growing gap points to an opportunity to invest in products where domestic supply is unable to meet demand.

The coming years will show whether India's planned investments can close this gap. The challenge is not simply to announce new plants, but to bring them into production in time to meet the needs of a growing plastics industry.



NEW METHOD TARGETS HARD-TO-RECYCLE PLASTICS

Researchers have developed a chemical process to recover plastic material and valuable reinforcing fibres from durable plastics used in vehicles and industrial equipment.

By Team ET Now Polymers

Some plastics are built to last, but that strength can make them difficult to recycle. A new method developed by researchers at the **University of Texas at Austin and Sandia National Laboratories** could offer a way to deal with one such material, used in products ranging from vehicle bumpers to construction equipment and chemical storage tanks.

The material, known as **poly(dicyclopentadiene), or pDCPD,** is valued for its strength, durability and light weight. However, its tightly linked molecular structure makes it difficult to break down using conventional recycling methods. As a result, products made from it may be incinerated or disposed of when they reach the end of their useful life.

The researchers have developed a chemical process that breaks down pDCPD and allows much of the resulting material to be recovered. Their findings were published in the journal *Science Advances* in September 2026.

Breaking down a tough material

The process uses a solvent and a catalyst containing ruthenium, a metal used in certain chemical reactions. The solvent helps the plastic break down, while the catalyst drives the reaction.

In the experiments, the

researchers used cyclopentyl methyl ether, a solvent selected for its comparatively favourable environmental properties. Under optimised conditions, the process broke down the plastic at 60°C over a period of about 72 hours.

The treated plastic dissolves into the solution, leaving material that can be separated and recovered as a powder. The researchers recovered more than 80% by weight of soluble polymer fragments across the different materials tested. Some of this recovered material could be used again in making plastics.

The method could also help recover valuable fibres used to strengthen plastic products. Glass and carbon fibres embedded in the material can be separated and recovered while retaining their physical integrity. This is important because conventional disposal methods, including incineration, can damage or destroy these reinforcing materials.



A possible alternative to incineration

The research addresses a problem faced by manufacturers using durable plastics and fibre-reinforced composites. These materials can perform well during their service life, but recycling them at the end of that life is often difficult.

Recovering both the plastic material and the reinforcing fibres could reduce the need for virgin raw materials. It could also provide an alternative to incineration, which consumes energy and can produce harmful by-products.

The researchers also examined the possibility of using the recovered material in new products. In laboratory tests, they incorporated up to 20% by weight of recovered polymer fragments into fresh pDCPD resin. The resulting material showed mechanical and thermal properties comparable to those of the original material.

This is an important step towards recycling the material back into useful products instead of simply breaking it down for disposal. However, the results are from laboratory research and do not yet establish how the process would perform in a commercial recycling plant.

Cost remains a challenge

Despite the encouraging results, some questions remain. The researchers need to establish how effectively the ruthenium catalyst can be recovered and reused. Catalyst costs could affect the economics of the process, particularly when large volumes of plastic need to be treated.

> Researchers have developed a chemical recycling process for pDCPD, a durable plastic used in automotive and industrial applications. The method recovers over 80% of the material, offering a potential alternative to incineration.

The size and thickness of the plastic components could also influence how quickly the chemical solution reaches the material and breaks it down. This may need to be addressed before the method can be used for large industrial parts.

The research team has filed a US patent application covering the technology. Further work will be needed to establish its commercial potential and the practical requirements for operating it at scale.

For plastics manufacturers, the work offers a possible way to extend the useful life of materials that are currently difficult to recycle. If the process can be made technically and economically viable, it could help recover valuable materials from durable plastic products that would otherwise be difficult to reuse.



MORE PLASTICS FIND THEIR WAY INTO MODERN CARS

From lighter components and electric vehicle batteries to safety systems and interiors, plastics are becoming more important in car design. The next challenge is to recycle more of these materials.

By Team ET Now Polymers

Plastics are taking on a bigger role in modern cars. From bumpers and dashboards to electrical systems and battery housings, these materials are helping automakers reduce weight, improve design and accommodate new technologies. Their growing use is also creating fresh opportunities for polymer producers and component manufacturers.

A report published by the **American Chemistry Council (ACC)** found that the average North American vehicle contained 428 pounds (about 194 kg) of plastics and polymer composites in 2025. This was an increase of 18% over a decade. These materials accounted for more than half of a vehicle's volume but less than 10% of its weight.

The global numbers also point to a substantial market. According to ICIS, the average light vehicle produced worldwide in 2024 used **187 kg of plastic resins.** With global production at 88.5 million light vehicles, this represented an estimated 16.6 million tonnes of automotive plastic resin demand. Polypropylene was the largest resin used in this sector, followed by polyurethane, nylon, PVC, ABS, polyethylene and polycarbonate, among other materials.

Why automakers are using more plastics

Weight reduction is one of the main reasons. A lighter vehicle generally needs less energy to move, which can help improve fuel efficiency in petrol and diesel vehicles. In electric vehicles, reducing weight can help improve driving range or allow manufacturers to meet performance targets with a given battery capacity.

Plastics also offer flexibility in design. They can be moulded into complex shapes, combine several functions in a single component and provide resistance to corrosion. Depending on the application, they can also help reduce the number of parts and assembly steps.

The material is not limited to visible components.

For automakers, the choice

of material depends on the job it must perform. A bumper needs to withstand impacts, an engine component must tolerate heat, and an electrical housing must provide suitable insulation and protection. No single plastic can meet all these requirements.

From bumpers to electrical systems

Polypropylene (PP) is widely used in automotive applications because it is relatively light and can be moulded into different shapes. Common uses include bumpers, interior trim, door panels and other components.

Polyurethane (PU) is used in seat cushioning, insulation and other applications where cushioning or flexibility is required. Polyvinyl chloride (PVC) is found in selected cable insulation, interior coverings and protective applications.

Engineering plastics have a different role. Polyamide, commonly known as nylon, is used in components such as air intake systems, engine covers and connectors. ABS is used in selected interior and exterior parts, while polycarbonate can be found in lighting and other applications where its properties are suitable.

These applications illustrate why automotive plastics cannot be treated as a single material category. Each resin has its own properties, processing requirements and cost.

The value of plastics in a vehicle is also changing. The ACC's 2025 report, estimated the value of plastics and polymer composites in an average North American automobile at US$709. This was 28% higher than a decade earlier. The figure measures material value, not the cost of all plastic parts fitted to a vehicle.

Electric vehicles add new opportunities

The shift towards electric mobility is changing the types of materials required in vehicles. EVs need components for battery systems, power electronics, charging connections and high-voltage electrical systems. Plastics can provide insulation, electrical protection and design flexibility in these applications.

Battery enclosures and covers are another area of interest. Depending on the design, these components may use engineering plastics or fibre-reinforced composites to meet requirements related to weight, strength, heat and impact protection.

However, EVs do not automatically use more plastic in every application. The amount and type of plastic depend on the vehicle design, battery technology and the materials selected by the manufacturer. The growth of EVs is therefore likely to change the mix of automotive polymers as much as it changes total demand.

ICIS identifies electrification as an important factor in the future of automotive plastics. In its outlook, global light vehicle production is projected to increase from 88.5 million units in 2024 to **95.8 million in 2030 and 112.5 million in 2050** under its base-case scenario. These are projections, not confirmed production figures.

India offers a large manufacturing base

India's vehicle production provides an important context for the plastics industry. According to the Society of Indian Automobile Manufacturers (SIAM), the country produced approximately 3.10 crore vehicles in FY2024-25 across passenger vehicles, commercial vehicles, three-wheelers, two-wheelers and quadricycles.

Passenger vehicle production reached 50.61 lakh units in FY2024-25, compared with 49.02 lakh in the previous financial year. Two-wheeler production stood at approximately 2.39 crore units. SIAM's figures show that production increased further in FY2025-26, with total vehicle output reaching approximately 3.47 crore units.

These figures cover the wider automotive industry, not just cars. They nevertheless demonstrate the scale of India's vehicle manufacturing base and the potential market for automotive components.

For polymer producers and processors, opportunities exist in supplying materials for interior parts, exterior components, electrical systems, under-the-bonnet applications and EV components. The actual demand for each resin will depend on vehicle production, the design of individual models and the level of local sourcing.

India's growth should not, however, be used to assume that domestic vehicles consume the same quantity of plastic as vehicles in North America or the global average. A reliable Indian estimate would require data specific to the country's vehicle types, materials and manufacturing practices.

Recycling becomes the next challenge

The growing use of plastics also raises a difficult question: what happens to these materials when a vehicle reaches the end of its life?

Recovering automotive plastics is not always straightforward. A vehicle contains different resins, composites, coatings, adhesives and other materials. Some parts are also difficult to separate economically.

The ACC's 2026 report points to the need for better dismantling, sorting and recycling systems. It also identifies opportunities to recover materials from components such as bumpers, foam seat cushions and battery housings.

Europe is moving towards stricter requirements. The European Union's new vehicle circularity rules set minimum recycled-plastic content requirements for new vehicle types: 15% from 2032 and 25% from 2036. At least 20% of the required recycled plastic must come from end-of-life vehicles or parts removed during vehicle use. The rules also aim to make vehicles easier to dismantle, repair and recycle.

For India, this creates an opportunity to develop better systems for recovering plastics from old vehicles and returning suitable material to manufacturing.

ET NOW MACHINIST
GLOBAL MANUFACTURING SUMMIT
Shaping Leadership & Transformation

BUILDING INDIA'S GLOBAL MANUFACTURING EDGE

Industry leaders at the ET Now Machinist Global Manufacturing Summit 2026 discussed how India can strengthen its manufacturing base through better supply chains, new technology and a skilled workforce.

By Team ET Now Polymers

India's ambition to become a global manufacturing hub will depend on more than increasing production capacity. Strong supply chains, better manufacturing practices, investment in technology and a skilled workforce will all play an important role in helping Indian companies compete in international markets. These were among the key themes at the **ET Now Machinist Global Manufacturing Summit 2026,** held in Pune on October 23.



The summit brought together senior industry leaders, manufacturing professionals and experts to discuss the opportunities and challenges facing the sector. The discussions covered India's ability to compete with established manufacturing economies, the need to build more reliable supply chains, the role of design and innovation, and the importance of people in an increasingly technology-driven industry.

As global manufacturing networks continue to change, India has an opportunity to strengthen its position as a production base for both domestic and international markets. However, making the most of this opportunity will require companies to improve quality, control costs, develop local suppliers and respond quickly to changing customer needs.

Manufacturing competitiveness is no longer determined by production costs alone. Companies must also deliver products on time, maintain consistent quality, adopt new technologies and manage disruptions across their supply chains. For Indian manufacturers, the challenge is to bring these different elements together while continuing to invest in capacity and capability.

The summit's opening keynote focused on the journey behind the Vande Bharat Express. Dr Sudhanshu Mani, the creator & lead of the train project, shared the theme of design and manufacturing through the lessons of the Vande Bharat project. The project offers an important example of the role that Indian



Dr Sudhanshu Mani, Creator, Vande Bharat Express

engineering and manufacturing can play in developing products for the country's needs.

The development of complex products requires coordination between design, engineering, production and suppliers. It also calls for teams to solve problems at different stages, from the initial idea to the final product. Such projects show why manufacturing capability cannot be built through machinery and infrastructure alone. It also depends on technical knowledge, teamwork, planning and the ability to turn ideas into working products.

For Indian manufacturers, developing this capability is important as the country looks to produce more sophisticated goods. Companies need to invest in product development, improve manufacturing processes and build teams that can handle complex projects. A stronger focus on design can also help Indian businesses move beyond contract manufacturing and develop products that offer greater value.

The summit also placed the question of India's global competitiveness at the centre of its discussions. The leadership panel, titled *India as a Global Manufacturing Hub: Competing in the New Industrial Era,* examined the factors that will shape the country's position in global manufacturing.

India's large domestic market offers manufacturers an important base for growth. At the same time, companies looking to serve international customers must meet global standards for quality, delivery and cost. This makes investment in technology, supplier development and production efficiency essential.

A supportive investment environment and a clear policy framework can help companies plan for the long term. However, manufacturers must also take responsibility for improving their own operations. Better production planning, effective use of resources, reliable delivery schedules and continuous improvement can help businesses build lasting relationships with customers.

Indian manufacturers will also need to strengthen their ability to supply global production networks. International customers increasingly look for suppliers who can meet their requirements consistently and respond to changes in demand.



Gagan Pal Singh, Senior Manager-Business Operations, Schmersal India

This creates opportunities for Indian companies, but it also raises expectations around reliability, quality and service.

The strength of the supplier network will be a key part of this effort. Large manufacturers depend on several smaller companies for components, materials, equipment

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L - R: Deepa Seshadri, Partner & CIO Program Leader, Deloitte India, Ashok Athawase Pralhad, Director- Manufacturing Excellence, SLMG Beverages (The Coco- Cola Company), Ankur Khaitan, Managing Director & CEO, TACC Limited (The Advanced Carbons Company), Manav Goel, Managing Director, Hoffmann Group-India, Milind Hardikar, Director – Group Strategic Initiatives, Welspun World, Yatendra Kumar, Business Head, MotulTech India, and Suneel TS, Assistant Vice President, Tata Group.

and services. If one part of this network faces a problem, the effect can spread across the entire production chain. Developing capable domestic suppliers can therefore help companies reduce risks and improve their ability to meet customer commitments.

Supply chains were another major focus at the summit. The session on building resilient supply chains for global manufacturing looked at issues such as supplier diversification, sourcing strategies, continuity of operations and India's place in global manufacturing networks.

Recent changes in international trade and production have made supply chain planning more important for businesses. Companies need to consider where they source materials, how much they depend on individual suppliers and what they can do if a shipment is delayed or a key input becomes unavailable. These questions are relevant to manufacturers across sectors, especially those that depend on specialised components or materials from different parts of the world.

Building a resilient supply chain does not simply mean finding more suppliers. Companies must identify reliable partners, understand the risks at different stages and maintain clear communication across their networks. They also need better visibility into the movement of materials and products so that problems can be identified early.

For India, these changes offer an opportunity to attract more manufacturing activity. Companies seeking to diversify their sourcing and production networks may look at Indian suppliers that can meet their technical and commercial requirements. To win this business, domestic manufacturers must demonstrate that they can deliver consistently and scale up when demand increases.

Smaller manufacturers and emerging businesses also have a role to play. They can support larger companies by providing specialised products, services and new solutions. However, access to technology, finance, skilled workers and markets remains important for these businesses to grow. Stronger links between large manufacturers and smaller suppliers can help build



L-R: Bhushan Mahal, Plant Head, Eaton Mobility Group's Ahilyanagar plant, Dhananjay Prasad, Vice President - Business Development, V-Trans India Ltd, Shiv Sood, Co-Founder, Sattva Human, Swastid Shrikant Badve, Head - Emerging Ventures & Investor Relations, Belrise Industries, and Manish Menon, Deputy General Manager - Product Planning & Research, Minda Corporation.



L-R: Neelam Pandey Pathak, Founder & CEO – WIMA, Social Bay Consulting LLP & Rozgar Dhaba, Kanchan Pant, CEO, Sharada Industries and Director, Algo Analytics, Kasturi Karandikar, Partner, Fine Fittings LLP and Founder -Studio, Maithli Sagar, Vice President, MIS & Commercial, Dyna-K Automotive Stamping Pvt. Ltd, Manika Goyal, Founder & CEO, Intellicloud Solutions, and Rujuta Jagtap, Executive Director at SAJ TEST PLANT PVT LTD

a more competitive industrial base.

Technology will be another important factor in shaping the future of manufacturing. Automation, digital systems and data-based decision-making are changing the way factories operate. These tools can help companies improve productivity, monitor equipment, reduce errors and make better use of materials.

However, technology adoption must be linked to clear business needs. Buying new equipment or installing digital systems will not automatically improve performance. Companies need to understand where technology can make a difference, train employees to use it and measure whether it is delivering the expected results.

Manufacturers must also prepare for changes in the skills required on the factory floor. As machines become more connected and production systems more advanced, employees will need a combination of technical knowledge, problem-solving ability and an understanding of digital tools. Companies that invest in training can help workers adapt to new processes while improving overall performance.

The summit's discussion on *The Human Factory: Workforce, Skills & Leadership of Women in Manufacturing for Industry 5.0* brought attention to the people behind industrial progress. Industry 5.0 places greater emphasis on the relationship between people and machines. While technology can take over repetitive tasks and support better decision-making, human judgement, creativity and experience remain important.

This shift also makes workforce development a business priority. Manufacturers need employees who can work with new systems, identify problems and suggest improvements. Regular training and opportunities to learn new skills can help companies retain talent and prepare their teams for future requirements.

Leadership will be equally important. Managers must help employees understand changes in production methods and give them the support needed to adapt. A workplace that encourages learning and problem-solving can help companies respond better to new demands.

The role of women in manufacturing was also part of this discussion. Greater participation of women across technical, operational and leadership roles can widen the talent pool available to the industry. However, this requires more than recruitment. Companies need to create workplaces where women have access to training, career development and opportunities to take on greater responsibility.

For manufacturing to grow over the long term, companies must treat people as an important part of their investment plans. Modern equipment and efficient processes matter, but their full value can be realised only when employees have the skills and support to use them effectively.

The discussions at the ET Now Machinist Global Manufacturing Summit 2026 reflected the range of issues that will shape India's manufacturing ambitions. Global competitiveness, product development, supply chain strength, technology adoption and workforce skills are closely linked. Progress in one area can support improvements in others, while gaps in any one of them can affect overall performance.

India has an opportunity to build on its manufacturing base and take on a larger role in global production. Achieving this will require sustained investment, stronger partnerships between companies, reliable suppliers and a continued focus on quality and productivity. It will also require businesses to prepare their people for changes in technology and the way factories operate.

The path to becoming a stronger global manufacturing hub will not be defined by capacity alone. It will depend on how effectively Indian companies combine engineering, technology, dependable supply chains and skilled people to deliver products that meet global expectations.



MEDICAL PLASTICS MOVE CENTRE STAGE

From life-saving disposables to advanced devices, polymers are reshaping healthcare while India builds manufacturing strength and faces a waste challenge.

By Team ET Now Polymers

Walk into any hospital today and you will find plastics almost everywhere. From syringes, IV bags and blood bags to surgical instruments, diagnostic equipment and implants, polymers have become an important part of modern healthcare. They may not always be visible to patients, but they play a major role in making medical treatment safer, more accessible and more affordable.

The reason is simple. Plastics are lightweight, durable, easy to mould into different shapes and can be designed to meet specific medical requirements. Many medical-grade polymers also offer good chemical resistance, flexibility and compatibility with different sterilisation methods. These properties have made them an important alternative to traditional materials such as glass and metal in several medical applications.

A growing global market

The demand for medical plastics is growing as healthcare systems expand, populations age and the use of advanced medical equipment increases. Home healthcare, diagnostic testing, minimally invasive procedures and wearable medical devices are also creating new opportunities.

According to Grand View Research, the global medical plastics market was valued at approximately **US$61.4 billion in 2025.** It is projected to reach US$66 billion in 2026 and nearly US$99.3 billion by 2033, registering an estimated compound annual growth rate (CAGR) of 6% between 2026 and 2033.

The growth is being supported by increasing demand for medical components, packaging, disposable products and equipment. The same research estimates that medical components accounted for around 41.7% of the global market in 2025.

These figures point to an important change: plastics are no longer limited to basic hospital consumables. They are becoming an integral part of advanced medical technology.

Which polymers are making a difference?

Different polymers serve different purposes depending on the medical application.

Polyvinyl chloride (PVC) is widely used in blood bags, IV bags, medical tubing and fluid-transfer systems because it can be made flexible and transparent. Polypropylene (PP) is commonly used in syringes, specimen containers, laboratory products and disposable medical instruments. Polyethylene (PE) is used in bottles, packaging, containers and protective products.

Polycarbonate (PC) is valued for its strength and transparency, making it useful in equipment housings, connectors and medical components. Polyethylene terephthalate (PET) is used in packaging and selected medical applications. Polyurethane (PU) offers flexibility and is used in catheters, tubing and other

specialised devices.

At the higher end, materials such as PEEK (polyether ether ketone) are finding applications in selected implants and orthopaedic devices because of their strength and performance. Silicone is another important material, used in medical tubing, respiratory products and implants.

The choice of polymer is not simply about cost. It depends on factors such as patient safety, biocompatibility, strength, flexibility, sterilisation requirements and the ability to perform reliably during use.

India: An important opportunity

India is emerging as an important market for medical devices and healthcare products. Rising healthcare spending, a larger network of hospitals, greater access to diagnostic services and increasing domestic manufacturing are creating demand for medical-grade plastics.

According to a March 2026 estimate by market research firm OMR Global, India's medical plastics market was valued at around **US$2.1 billion in 2025** and is projected to reach US$4.9 billion by 2035, growing at an estimated CAGR of 8.9%.

The wider medical devices industry also offers a strong indication of the opportunity. India Brand Equity Foundation (IBEF) reports that the country's medical devices market was valued at around US$15.2 billion in 2025 and is projected to reach approximately US$50.1 billion by 2030. This is the broader medical devices market, not the plastics market, but its expansion is likely to create opportunities across the medical polymer supply chain.

Government data released in March 2026 adds to this picture. India had 4,108 licensed medical device manufacturers. Exports of medical devices reached **US$4.014 billion in FY2024-25,** compared with US$3.785 billion in the previous financial year. Of particular interest to the plastics industry, exports of consumables and disposables alone stood at US$1.863 billion in FY2024-25.

The government is also supporting domestic manufacturing through the Production Linked Incentive (PLI) scheme for medical devices, with a budgetary outlay of Rs.3,420 crore. As of December 2025, 24 greenfield projects had been commissioned under the scheme and production had started for 57 products.

For India's plastics industry, this presents opportunities in medical-grade raw materials, precision injection moulding, extrusion, flexible tubing, sterile packaging, connectors and specialised components. It also creates scope for greater collaboration between polymer manufacturers, medical device companies and research institutions.

The sustainability challenge

However, the growing use of plastics in healthcare also brings a serious responsibility. Hospitals depend on many single-use products because patient safety and infection control must come first. Syringes, gloves, tubing, protective equipment and other disposable products are often used for a short period and then discarded.

The World Health Organization (WHO), in its October 2024 healthcare waste fact sheet, estimates that around **85% of healthcare waste is general, non-hazardous waste,** while the remaining 15% is hazardous and may be infectious, toxic or radioactive. The WHO also estimates that around 16 billion injections are administered worldwide every year.

It is important to understand that these figures cover all healthcare waste, not plastics alone. However, they highlight the scale of the waste-management challenge facing hospitals and healthcare systems.

A major concern is that medical plastics cannot all be treated in the same way as ordinary household plastic waste. Products contaminated with blood, body fluids or infectious material need appropriate handling and treatment. Mixing such waste with clean recyclable plastics can create health and safety risks.

A research review published in the journal *Resources, Conservation and Recycling* in June 2025 examined 133 studies on the circular economy of healthcare plastics. It found that recycling alone is not enough. Better product design, proper segregation at source, reuse where safe, suitable recycling systems and cooperation across the healthcare value chain are all needed.

For manufacturers, this means sustainability must become part of product development itself. Designing products with fewer materials, reducing unnecessary packaging and developing recyclable solutions for suitable non-contaminated applications can help. Reusable medical products may also be considered wherever they meet safety and performance requirements.

What lies ahead?

The future of medical plastics will be shaped by innovation as much as by demand. Advanced polymers, bio-based materials, 3D-printed medical components, smart devices and improved material designs are opening new possibilities. There is also growing interest in materials that offer better performance while reducing environmental impact.

For India, the opportunity is particularly significant. The country has the potential to move beyond supplying basic medical consumables and become a stronger manufacturing base for high-quality medical devices and specialised polymer components.

The challenge will be to combine affordability, quality, patient safety and sustainability. Plastics have already changed the way healthcare is delivered. The next step is to make this partnership smarter, safer and more responsible.



EUROPE MOVES CLOSER TO CURBS ON PET IMPORTS

Five EU countries have sought action on PET imports as Europe's chemical industry battles high costs and growing competition from overseas suppliers. Indian exporters face uncertainty

By Team ET Now Polymers

Europe is moving closer to tighter controls on plastic imports, raising fresh questions for Indian polymer exporters. The European Union (EU) is considering measures to protect its domestic industry from rising imports, particularly from China, at a time when chemical producers across the region are struggling with high energy costs and weak demand.

The issue gained momentum in October after five EU countries reportedly submitted a request to the European Commission seeking safeguards on imports of polyethylene terephthalate (PET), a polymer widely used in packaging and beverage bottles. The request followed an earlier push by France, Italy and Germany for stronger protection for Europe's chemical and plastics industries.

The Commission was expected to decide within 30 days whether to open a formal investigation into the PET request. European Trade Commissioner Maroš Šefčovič said that plastics appeared to be the sector closest to a possible new investigation. However, the filing of a request does not mean that fresh restrictions have been imposed.

Why Europe wants to act

European chemical and plastics manufacturers are facing pressure from several directions. High energy costs have made production expensive, while weak demand has affected business conditions. At the same time, producers are dealing with competition from overseas suppliers offering materials at lower prices.

China is a major part of the

debate. European policymakers are increasingly concerned about the impact of rising Chinese exports on local manufacturing, jobs and industrial competitiveness.

The broader trade relationship has also come under pressure. The EU's goods trade deficit with China exceeded €370 billion in 2025 and could rise further in 2026. European governments are therefore looking at ways to protect domestic industries while continuing discussions with Beijing.

France, Italy and Germany have supported stronger scrutiny of imports of selected chemicals and plastics. Products discussed in the initial proposal included PET, epoxy resins and glass fibres. These materials serve different industries, ranging from packaging and construction to automotive manufacturing, energy and infrastructure.

How the proposed safeguards could work

Safeguard measures are different from conventional anti-dumping duties.

Anti-dumping measures are intended to address imports sold at unfairly low prices that cause injury to domestic producers. Safeguards, on the other hand, can be used when a significant increase in imports causes, or threatens to cause, serious injury to an industry.

Under the proposed approach, import quotas could be set for different exporting countries. Additional duties could apply to shipments exceeding the permitted quantities.

> "Europe is considering stringent measures on PET imports as domestic producers face pressure from low-cost overseas competition and high energy costs. However, proposed safeguards may reshape trade flows, creating uncertainty for exporters, including India.

The important difference is that safeguards generally apply to imports from all countries, rather than only to a specific country accused of unfair trade practices. This means exporters could be affected even if their products are not from China.

The European Commission would need to examine whether the increase in imports meets the legal requirements for safeguard action. These include evidence of serious injury, or the threat of serious injury, to European producers, along with an assessment of whether the measures are in the EU's interest.

Until that process advances, the proposed restrictions remain uncertain. The final outcome would depend on the findings of any investigation and the decision taken by the Commission.

What it could mean for India

For Indian polymer producers, the developments warrant close attention. Europe is an important market for several chemical products, and any change in its import policy could affect exporters' access to the region.





The implications, however, will vary by product and company.

India already faces trade restrictions on certain PET shipments to the EU. In August 2025, the European Commission renewed countervailing duties on specified PET imports originating in India following an expiry review. The Commission's assessment noted that Indian PET imports into the EU had fallen sharply, from more than 122,000 tonnes in 2020 to a small volume of around 1,500 to 2,500 tonnes during the review investigation period.

This existing measure is important because the proposed safeguards would not be the first trade barrier affecting Indian PET exporters. Any additional action would need to be assessed alongside the duties already in force and the precise product coverage of the new case.

There could also be wider effects on trade flows. If access to the European market becomes more difficult for some suppliers, exporters may look for customers elsewhere. This could increase competition in markets where Indian manufacturers are already selling their products.

For Indian companies, the outcome could therefore depend on their product mix, export destinations, pricing and ability to compete in alternative markets.

Epoxy resin manufacturers also have reason to monitor the debate. India exported epoxy resins worth approximately **$111.5 million in 2025,** according to World Bank trade data. Germany accounted for about $9.6 million and Italy for around $7 million of these exports. These figures underline the importance of European customers, although the initial PET request does not itself establish that epoxy resin imports will face new restrictions.

A wider shift in European trade policy

The developments point to a broader change in Europe's approach to trade protection. The EU has traditionally relied more heavily on anti-dumping and anti-subsidy investigations targeting specific products and countries. Safeguards offer a wider instrument, but they also carry the risk of affecting established suppliers and buyers across the supply chain.

For plastics converters and packaging manufacturers, tighter import controls could change sourcing options and the availability of raw materials. Depending on the quotas, duties and market response, buyers could face higher costs or have to find alternative suppliers. European producers, meanwhile, could gain some protection from import competition.

The challenge for policymakers will be to support domestic manufacturing without placing an excessive burden on industries that depend on imported raw materials.

For Indian exporters, the immediate task is to track the Commission's decision on the PET request and examine the possible impact on individual product categories. The next important development will be whether a formal investigation is opened, followed by details of the products and countries covered.

For now, Europe is moving towards a tougher approach to selected imports, but the extent of the impact on Indian polymer exporters will depend on the measures ultimately adopted.

Smarter Motion, Better Output: How Automation Is Raising the Bar for India's Plastics Machinery

By Inovance

India's plastics industry is being asked to do more with less. Packaging, automotive, consumer goods and pharma customers expect tighter quality at higher speed, while energy costs and sustainability targets leave little room for waste. For machine builders and processors, much of the answer lies inside the machine itself. The drive, motor, controller and HMI decide how precise, efficient and dependable a machine will be, which is why automation has moved from a supporting role to the centre of competitiveness.



From injection moulding to thermoforming Inovance servo systems, AC drives, PLCs and HMIs for precise, energy-efficient plastics machines

Why the control system matters

Whether the machine is an injection moulder, an extruder, a thermoformer or a converting line, buyers ask for much the same things: repeatable precision, lower energy consumption, stable speed at high output, quick changeovers and easy service. These goals are met most reliably when motion, drive and control technologies are designed to work together instead of being assembled from unrelated parts. This integrated approach is the foundation of Inovance India's offering, which spans AC drives, servo systems, PLCs, motion controllers, HMIs and industrial robots.

Injection moulding: precision with lower energy use

Injection moulding is where Inovance has built its deepest base in India. For servo-hydraulic machines, the IS580 servo drive is designed specifically for energy-saving servo pump applications and works with the ISMG servo motor, which is built for the same duty. Together they let the pump deliver only the flow and pressure the cycle needs, cutting power consumption without compromising response.

For machines that demand higher performance, including fully electric designs, the newer ES680 servo drives and MEG motors offer high torque, stable control and good energy efficiency. They are complemented by smart controllers for fully electric machines, which bring real-time data analysis, energy management and predictive maintenance into the machine, helping processors reduce downtime and meet tougher environmental expectations.

Thermoforming, film and converting machines

The same thinking applies across the wider plastics machinery family. In multi-station thermoforming machines, forming, cutting and stacking must stay in step at high cycle rates. Servo-driven axes, such as Inovance SV680 servo systems, working under an EtherCAT motion controller can keep every station synchronised and positioned accurately. In flexo printing and other converting machines, the same combination of precise multi-axis motion and a clear operator interface supports print registration even at production speeds.

For bag and wrapper making machines, an Inovance solution built around the MD310 compact AC drive, the SV660N servo drive with MS1 servo motor, the H5U PLC and the IT7000 HMI has helped machine builders achieve smaller cabinets and easier commissioning. The HMI also gives operators machine diagnostics, so that components can be replaced quickly, even by staff who are not specialists.

Expanding to blow moulding, hydraulic presses and die casting

Having established itself in injection moulding, Inovance is extending the same technology to blow moulding, hydraulic presses and die-cast machines. In blow moulding, accurate control and efficient drives help manufacturers produce bottles, containers and automotive parts with more consistent quality and lower power consumption, and the benefits of faster response and reduced downtime carry over to presses and die casting.

Support that keeps machines running

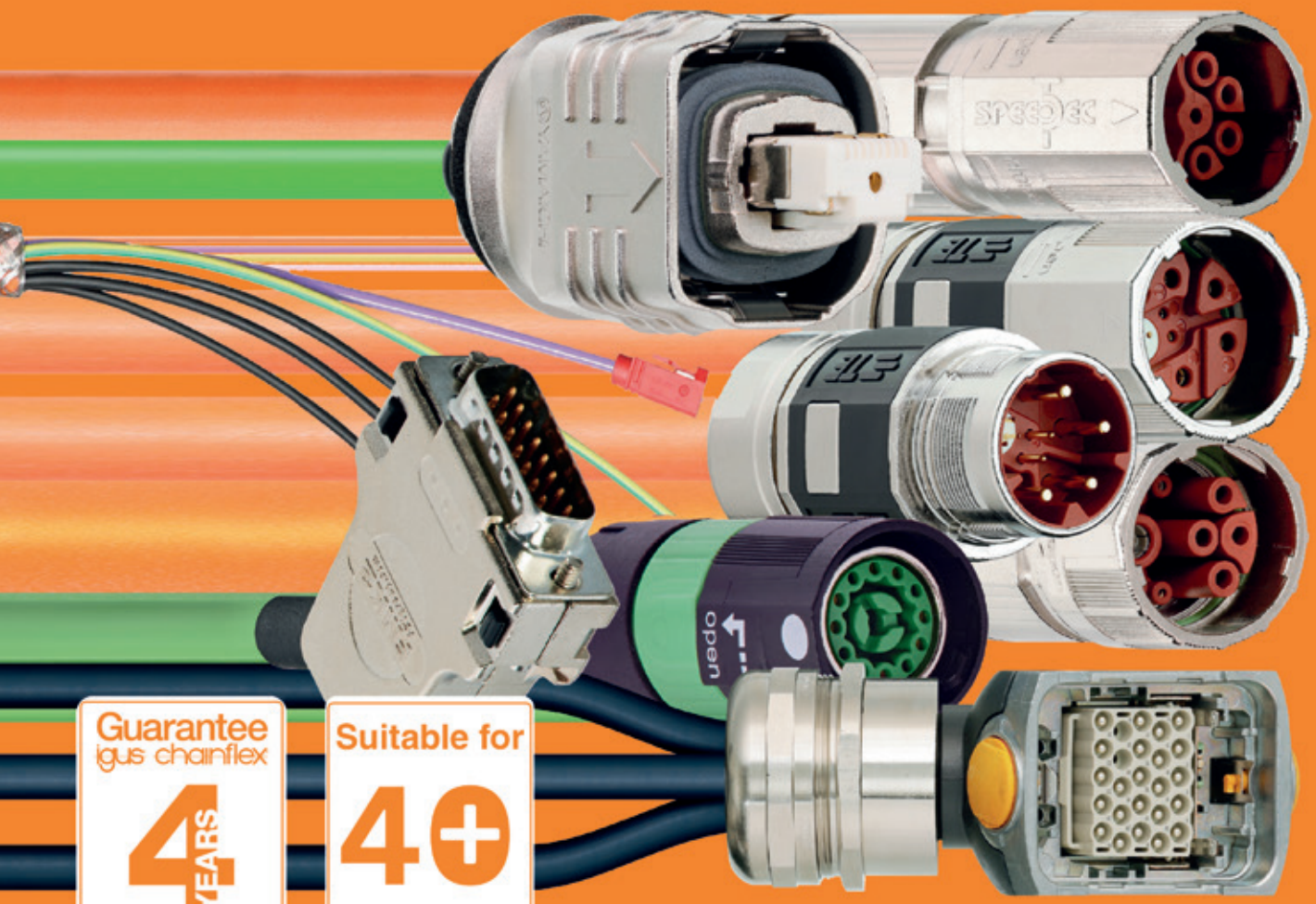
Technology performs best with strong support behind it. Inovance India serves customers through channel partners and trained service engineers, and regularly holds technology seminars and product training so that machine builders and processors can get the most from their equipment.

The road ahead

Smarter, more connected and more energy-efficient machines are quickly becoming the norm. Inovance India will continue to work with machine builders and processors to bring these capabilities to Indian plastics machinery and to help it compete confidently in global markets.

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