Materials transformation is **integral** to long term growth

GLOBALLY INDUSTRIES ARE LOOKING FOR NEW MATERIALS HAVING BETTER FEATURES SAYS **SHYAM SUNDAR S PANI,** DIRECTOR, MARKETING AND COMMUNICATIONS, STEER ENGINEERING PVT. LTD.

What is spurring material transformation in the plastics industry?

Materials are responsible for changing the way new products are being designed and developed to ensure that the enhanced features and functionality are appealing to the rapidly evolving consumer segment as well as from the industry demand perspective. Irrespective of whether they are household, industrial or defence related products and components, newer materials displaying better physicochemical properties and performance are entering the market. These materials should not only display the potential to withstand acute deterioration because of physical, chemical and environmental stress, but also eco-friendly and sustainable in manufacturing.

Why is it important to master effective transformation of materials?

Let's take a few examples to justify this. Global car manufacturers are exploring several types of materials to reduce the weight of vehicles for fuel efficiency. At the same time, they need materials that meet their business objectives and stringent requirements.

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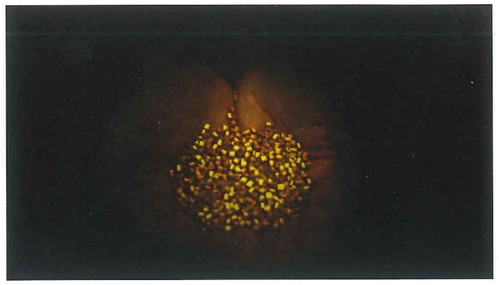
Similarly, aircraft manufacturers are experimenting with new generation materials to build bigger and better fuel-efficient aircraft aimed at revolutionising global transportation. Today, automobiles and aeronautical industries are growing at an exponential rate, particularly in the emerging economies. Both are at the forefront of innovation and the plastics industry has a bigger role in this transformation.

What are the challenges faced by the plastics industry in ensuring effective transformation of materials while compounding?

One of the familiar challenges is obtaining an optimum dispersion and distribution of pigments into the polymer matrix. For example, not all technology platforms can successfully achieve good dispersion of blue organic pigment (colour masterbatch for multiple end-user applications in the plastics industry). As the particle size is minute, it drastically loses chemical and physical properties during processing. If the dispersion in the polymer matrix is not optimum, it will affect the physical properties of the pellets. Eventually, the blue masterbatch will be unfit for use in any end applications. The formulation, processing parameters, screw design and processing techniques must be right. Suppose we get the desired dispersion, the next challenge is to mix it with other materials. Plastics can incorporate other ingredients and



such an effective modification leads to transformation.

So, you mean that the challenge to effectively transform materials remains a challenge?

Though technology platforms to transform materials effectively are today widely available, not all of them have mastered control over three factors - Control over Temperature; Pressure applied and Time consumed for Processing Materials. A correct combination of these three can usher in better control over transformation of materials. Extensive R&D work is in progress to evolve 21st century processing platforms. For instance, a platform technology aimed at continuously processing materials with self-cleaning ability resulting in a chemical reaction to increase the molecular weight or viscosity without gelling, is spurring the development of newer extrusion technology using co-rotating twin-screw extruder at STEER. We have been successful in transforming materials by mixing rubber, jute, natural fibers, edible ingredients, seaweed, soya seeds, and even chicken feathers!

Can you elaborate on a specific case study where STEER has been successful in materials transformation?

Yes. At our Application Development Centre in Bengaluru, we developed a process for a compound comprising Aluminium Trihydroxide (ATH) flame retardant, Polylactic Acid (PLA), chopped glass fiber, silicon oil, and plasticizer (oil). Achieving an optimal dispersion of these complex additives while protecting the PLA from degradation is a challenge as PLA and ATH are highly sensitive to heat and shear. PLA will have excessive loss of molecular weight and properties while ATH will degrade to lose

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its flame retardant capability. There are other challenges - ATH loses its water molecules when heated or sheared while PLA is sensitive to hydrolysis in the presence of water. If ATH loses its water during processing, water will hydrolyze the PLA. Therefore, water must be removed immediately using vacuum venting after PLA is melted.

After multiple trials, we were successful in producing an output that retained the properties of the PLA, provided optimal dispersion of the ATH and oils while preserving the length of the reinforced glass fibers. The favourable performance resulted in sale of a STEER Omega class extruder to produce PLA product lines.

What is the way forward for materials transformation from the long-term perspective?

Material transformation is all about doing it right with least energy, inputs, and Specific Mechanical Energy Input (SMEI). For instance, a good compound is the result of a thorough understanding of what goes inside the 'extruder processing zone (EPZ)' for materials transformation. The key to success lies with the design of the 'element & barrel' configuration and the shaft design. A reliable materials processing platform technology, which can deliver the desired results, is important for the plastics industry to sustain growth in the long-term. Materials transformation is all about bringing multiple ingredients together and mixing them effectively to evolve better and newer applications, especially for businesses in the core sectors of the economy.

Source: STEER Engineering Pvt. Ltd.