Aditya Prakash Shembekar
PhD student, University of Edinburgh

Sustainable Solutions for the Automotive Industry: Thermomechanical Recycling of Continuous Glass Fibre (GF) Reinforced Polyamide-6 (APA6) Composites

Aditya Shembekar [1], Jason Yu [2], Christopher Griffin [2], Dipa Ray [1,*]

[1] School of Engineering, Institute for Materials and Processes, The University of Edinburgh, Sanderson Building, Robert Stevenson Road, Edinburgh EH9 3FB, UK

[2]Johns Manville, 10, 100, West Ute Ave., Littleton, CO 80127, USA

In the pursuit of reduced carbon emissions, fibre reinforced polyamide composites have emerged as essential materials in the construction of lightweight automotive vehicles. In recent years, development of modern processing techniques has facilitated mass production of these composites. Owing to this, the global polyamide composite market is projected to reach $17.61 billion by 2027, expanding at a compound annual growth rate (CAGR) of 9%. This also indicates that in the years ahead, we will have to confront the issue of dealing with millions of tons of End of Life (EoL) polyamide composite components. According to the Environmental Protection Agency (EPA), only 7% of total plastic globally produced is recycled, while another 8% is incinerated and 85% is sent to landfills. Therefore, many countries are now introducing binding regulations on landfilling and incineration. Thus, it is of paramount importance to find sustainable solutions for recycling of EoL composites. Several methods of recycling have been studied so far; among these methods, mechanical recycling has been envisioned to guarantee environmental and economic feasibility on an industrial scale. However, mechanical recycling typically involves shredding of thermoplastic composites and post-processing of the shredded material by injection moulding. This often results in deterioration of the properties of the recycled material due to shortening of the fibre length. Any way of retaining the fibre length can add higher value to the recycled products. In this regard, our study focuses on reprocessing of glass fibre (woven 2/2 twill GF) reinforced polyamide-6 (APA6) composites by compression moulding. The effects of various reprocessing conditions on the crystallinity, average molecular weight, void content, fibre alignment was studied and correlated with the mechanical properties. This recycling strategy addresses a viable route for recycling of EoL automotive components.

Keywords: Automotive, end of life, composite, polyamide, fiber, compression molding