eXPRESS Polymer Letters Vol.13, No.12 (2019) 1026
Available online at www.expresspolymlett.com
https://doi.org/10.3144/expresspolymlett.2019.89

Editorial corner – a personal view
Recycled carbon fibre: A promising future

Z. A. Mohd Ishak

Cluster for Polymer Composites, Science and Engineering Research Centre, Engineering Campus, Universiti Sains Malaysia, 14300 Nibong Tebal, Pulau Pinang, Malaysia

The global market for carbon fibre is expected to reach about 140 000 Mt in the 2020s and to register a CAGR of 12.07% during the forecast period, 2019–2024. Carbon fibre is a perfect choice as reinforcement in polymers for numerous applications, i.e. the aerospace, defence, automobile, construction, sports, and leisure sectors as they provide lightweight, high strength and modulus. It is estimated that more than 30% of carbon fibre ends up as waste at some point during the manufacturing processes (in the form of dry fibres, cured and uncured prepreg, and laminates). Much effort in both academia and industry has been concentrated on developing cost-effective and environmentally friendly techniques of reclaiming carbon fibres without significantly deteriorating their quality. Recycling processes can be broadly grouped into mechanical, chemical and thermal recycling. From an industrial perspective, pyrolysis has been proved to be commercially viable in producing high-quality recycled carbon fibres. The recycled carbon fibre does not only retain 90-95% of its original mechanical properties but also possesses a high quality surface, which allows for strong fibre-matrix interfacial bonding.

Recycling carbon fibre can reduce waste in landfills by thousands of tons each year and provides much cheaper carbon fibre for various types of applications. Thus, the real issue here is not only to develop a technique for recycling carbon fibres, but also to get them back into the supply chain in products containing recycled carbon fibres. Recycled carbon fibres can replace short virgin fibres in non-structural applications that use short fibre reinforced thermoplastic composites. The cost of recycled carbon fibre is typically 40% cheaper than that of virgin carbon fibre. In the automotive industry, recycled carbon fibres in milled or chopped forms can be reused in suitable thermoplastics, such as polyamide to produce components for under-the-hood applications, and interior and exterior body panel applications.

For recycled carbon fibre to be attractive for structural applications, e.g. in sheet moulding compounds, the fibre should be made available in non-woven mats. Recycled carbon fibre of appropriate length can be made into non-woven mats with the needle punching technique. Also, high-performance composites could also be produced through blending recycled carbon fibres with thermoplastic fibres. It is essential to classify recycled carbon fibres and the related waste according to fibre grade and fibre length for optimised fibre use. Good cooperation between generators of carbon fibre waste and recyclers will result in higher quality feedstocks, which would eventually lead to the production of higher-quality recycled carbon fibre. A sustainable supply of high quality recycled carbon fibres at an affordable price is pivotal for a future increase in the use of recycled carbon fibres. Strong cooperation between stake-holders, namely waste generators (who supply high-quality feedstocks), recyclers, researchers, component manufacturers and end-users is essential for recycled carbon fibre to achieve substantial market penetration.

Prof. Dr. Zainal A. Mohd Ishak
Member of the International Advisory Board

*Corresponding author, e-mail: zarifin.ishak@googlemail.com