Editorial corner – a personal view

The ongoing impact of carbon (allotropic forms)/polymer composites

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Carbon reinforced polymer composites are in the front line of technological applications and research interest for decades. Tire industry, aerospace and automotive industry, production of sport and leisure goods, microelectronic and electrochemical manufacturing are some of the main fields of carbon/polymer composites applications.

Carbon lies in the IV column of the periodic table, being the lightest element of the column. It differs substantially from the rest column's elements due to its ability to form sp^2 bonding. Carbon is found in two allotropic forms in nature, diamond and graphite. Carbyne and fullerenes are two additional allotropic forms of carbon, chemically synthesized.

The significant impetus in the carbon reinforced polymer composites (CRPs) was given by the industrial production of carbon fibres. Although, the earliest reference for commercial use of carbon fibers goes back to the late 1800s, practical end use products utilizing carbon fibres first appeared in the 1960s. Car racing and aerospace industries were the pioneers to exploit the high modulus, high strength, and low weight properties of CRPs. On the other hand, the electrical properties of particulate CRPs, such as carbon black composites, were also intensively investigated.

The advent of nanotechnology era and the development of various types of polymer matrix nanocomposites gave the opportunity for a new breakthrough in the field of CRPs. Carbon nanoinclusions, such as single- and multi-wall carbon nanotubes, carbon nanofibres, exfoliated graphite nanoplatelets, and

recently graphene, embedded in a polymer matrix result in composite systems with improved mechanical and tribological characteristics, enhanced heat resistance, and advanced optical and electrical behaviours.

Mutual interactions between carbon nanoinclusions and interactions between polymer macromolecules and carbon nanoparticles, as well as, missing of methods to achieve homogeneous or preferential distribution of nanofillers, are current drawbacks of nano-CRP technology, in tandem with their economic cost. These aspects are in the focus of worldwide research efforts, in the field, since controlling the distribution state and tuning the polymer-nanofiller interactions will allow full tailoring of the overall performance of composite structures.

The diversity of possible polymer matrices and carbon nanoinclusions – currently available and forthcoming ones – for the production of nano-CRPs, indicate that perspectives for future development are wide open.

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