Processing Routes for Achieving Multi-Functionality in Reinforced Polymers and Composite Structures

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Abstract

Multi-functionality is the combination of different properties in one material so as to make it suitable for the use in applications in which different loading conditions must be sustained. Besides the mechanical load bearing capacity, other properties such as thermal stability, electrical conductivity or wear resistance can be of importance. In many cases, polymer based composites are the material of choice, since they can combine the intrinsic properties of the polymers (like light weight, corrosion resistance or toughness) with the unique properties of their reinforcements (such as electrical conductivity, wear resistance, or high mechanical stiffness and strength.)

The present contribution illustrates how multi-functionality can be achieved in reinforced polymers and composite structures, using different types of polymer matrices and various nano-sized and micro-sized fillers, reinforcements or coatings. Besides the principle concepts, various case studies are represented, illustrating different processing routes how to achieve various property combinations for different specific applications.

The latter include high temperature thermoplastic based composites for sliding wear loaded components, carbon nanotube/short fiber reinforced thermoplastics used for paintable automotive fenders, film coated composites structures, in which high stiffness and strength together with high surface erosion resistance are required (e.g. wind energy rotor blades), electrically conductive thermosetting coatings used for corrosion protection of metallic pipeline systems, and high temperature thermosetting coatings for reducing sliding friction and wear of automotive engine pistons, etc.

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