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ADVANCED POLYMER NANOCOMPOSITES BASED ON INORGANIC NANOTUBES AND FULLERENE-LIKE NANOPARTICLES: NOVEL PROPERTIES AND APPLICATIONS

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RESUMEN

Organic-inorganic hybrid materials are found at the natural interface between two worlds of chemistry each with very significant contributions to the field of materials science, and with characteristic properties that present numerous advantages. In this respect, the use of environmentally friendly tungsten (molybdenum) disulfide (WS2/MoS2) inorganic fullerene-like nanoparticles (IFs) and nanotubes (INTs) has resulted in significant improvement in thermal, mechanical, physical, and surface properties of polymers and polymer matrix composite resins. The surprising properties of these layered metal dichalcogenides such as high impact resistance and superior tribological behavior open up a wide variety of opportunities for applications in, for example, the automotive and aerospace industries, electronics and medical technology and, more particularly, in the field of polymer nanocomposites (Naffakh el al. Prog Polym Sci 2013, 38, 1163-1231).

The property improvements enabled by these nanostructures have resulted in their use with other organic micro-particles (nucleating agents), micro-fibers (carbon fibers) or nanofillers (carbon nanotubes) to tailor more sophisticated hybrid materials with complex architectures, interactions, morphology and functionality. In addition to property improvement, production of novel functional nanomaterials at reduced cost is also desired. In this way, the use of IF/INTs has been recently recognized as one of more cost-effective methods to improve the crystallization and mechanical performance of biodegradable and renewable thermoplastics (e.g. PLLA, PHB) without the need for modifiers or surfactants via conventional melt blending (Naffakh at al. CrystEngComm 2014, 16, 5062-5072). Furthermore, low cytotoxicity of IF/INTs in human cells assessed by recent in-vitro studies support their safe application. An exciting opportunity exists for research in the area of nanocomposite polymer biomaterials (Naffakh at al. J Mater Chem B 2014, 2, 4509-4520).

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