Non-covalent surface treatment of carbon nanotubes: from catalyzed polymerization to high performance nanocomposite materials

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Due to their remarkable properties combined with low density, carbon nanotubes (CNT) are more and more considered as reinforcing nanofillers for polymer matrices. However, the key-challenge remains to reach high level of nanoparticle dissociation (i.e., to break down the ropes of aggregated nanotubes) as well as fine dispersion upon melt blending within the selected matrices. Among the various disaggregating strategies studied, we investigate non-covalent (supramolecular) surface treatment of the CNTs allowing for complete destructuration of the native filler aggregates without any loss of the inherent properties of the electro-conductive nanotubes. Indeed, it is known that more conventional covalent surface treatment of CNTs often reduce their electrical conductivity and other mechanical performances. First we studied the the so-called "polymerization-filling technique" (PFT) for coating the nanotubes with a thin polyolefin layer, which is formed by in situ polymerization process catalyzed directly from the nanofiller surface. Secondly attention has been drawn on non-covalent functionalization/polymer "grafting" of the nanotube surface via either π–π stacking, cation-π bonding, charge transfer or CH-π interactions. Extent of CNT disaggregation and quality of dispersion in solvents and polymer matrices will be presented as well as some selected applications in fields as versatile as solar cells, electro-conductive bioplastics and anti-biofouling coatings.