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Self-Organized Grafting of Carbon Nanotubes by End-Functionalized Polymers

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Carbon nanotubes have outstanding physical and chemical properties due to their idealized one-dimensional structure consisting of sp2 hybridized carbons. The practical utilization of superior properties of individual nanotubes, however, has been limited by the bundling of nanotubes, which originates from strong tube-tube interaction. In order to utilize the superior properties of individual carbon nanotubes, we introduce a facile and robust self-organized functionalization method for carbon nanotubes utilizing end-functionalized polymers. Various polymers end-functionalized by terminal groups such as amines, hydroxyl or carboxylic acid groups are spontaneously grafted to the carbon nanotubes through a simple solution mixing process. The noncovalent functionalization enhances the dispersibility of carbon nanotubes in organic solvent and polymer matrix.

Keywords: carbon nanotube, noncovalent functionalization, end-functional polymer

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Polymer/Carbon Nanotube nanocomposites by noncovalent functionalization Using End-Functionalized Polymers

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Polymer/carbon nanotube (CNT) nanocomposites still have a few issues to be overcome for practical applications. CNTs spontaneously bundle due to the strong Van der Waals interaction. The bundled CNTs may slip each other, following the initiated cracks in nanocomposites rather than reinforcing them. Another significant issue is the interfacial adhesion with a polymer matrix. It is more critical for CNTs than any other filler because the CNT surfaces are extremely smooth and the interfacial area is huge. If a strong polymer/CNT interface is ensured, the exterior load on the matrix would be efficiently transferred to nanotubes and the excellent mechanical properties of nanocomposites could be accomplished. Here, we fabricated polymer/CNT nanocomposites relying upon a facile and robust noncovalent CNT functionalization method using end-functionalized polymers. The end-functionalized polystyrene was used for dispersant to enhance the dispersibility of carbon nanotubes in polymer matrix. The nanocomposites were fabricated through simple solution mixing process and their optical, electrical, and mechanical properties were investigated.

Keywords: carbon nanotube, nanocomposite, noncovalent functionalization