MULTI-WALLED CARBON NANOTUBE – CERAMIC NANOCOMPOSITES WITH ENHANCED MECHANICAL PROPERTIES

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Carbon nanotubes are unique materials, which are at the forefront of the nanotechnology revolution due to their extraordinary mechanical, thermal, and electrical properties. They are amongst the strongest materials known to man making them ideal candidates as reinforcing elements in ceramic based materials. Their use in this capacity is contingent on dispersing the nanotubes throughout the host material and fostering nanotube – matrix interactions while ensuring the integrity of the nanotubes. However, strong inter-tubular van der Waals forces facilitate nanotube bundling limiting their solubility in common solvents and ultimately, the host matrix. In addition, ceramics are typically processed at temperatures in which nanotube thermal decomposition is anticipated.

A comprehensive understanding of the fundamental thermodynamics that govern nanotube dispersive behavior has yet to be published. Such quantitative results are essential in successfully synthesizing nanocomposites with enhanced mechanical properties. In this work, nanotube surface energetics were calculated by analyzing functionalized nanotube solubility in a host of solvents. To mitigate nanotube destruction, low temperature ceramic synthetic routes have been explored including sol-gel processing and pyrolytic treatment of polymeric precursors.