Journal of Aeronautics & Aerospace Engineering

Wu, J Aeronaut Aerospace Eng 2012, 1:4
DOI: 10.4172/2168-9792.1000e119

Editorial Open Access

Carbon Nanotubes Reinforced Nano-Composite Materials and Their Application in Aeronautics Engineering

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Since their discovery in early 1990's, carbon nanotubes (CNTs) have been extensively studied. The studies on the fabrication and properties of CNTs, either as single nanostructures or as Nano-composites, have become one of the most attractive research topics in the material physics and Nano-technology [1-3]. The remarkable electrical, mechanical, and thermal properties of (CNTs) enable them to be used for the development of Nano-electromechanical devices and new materials with the high mechanical strength, low mass densities and outstanding electrical and optical properties. Actually, CNTs are the strongest and stiffest materials yet discovered in terms of tensile strength and elastic modulus respectively. The advanced mechanical properties have lead to a great motivation for mechanical, aerospace and civil scientists and scholars to reveal and explore the potential applications of different CNTs and the Nano-structures.

The development of composite materials reinforced with CNTs is one of these applications by taking advantages of the CNTs' superior mechanical strength, their high aspect ratio and light weight. Compared with other additives and reinforcement materials, for example carbon and glass fibers, CNTs were found to be well combined with ceramics, metals and polymers by filling the gaps inside the structures as Nano-particles. These embedded CNTs usually play a role to support the matrix so as to increase the macroscopic mechanical strength of the composites. For ceramic matrix materials, the mechanical property of greatest importance is enhancing toughness or resistance to possible crack growth due to the great tensile strength of CNTs. For metal matrix materials, enhanced stiffness, wear, and fatigue resistance could also be achieved by the incorporation of the CNTs [4]. Furthermore, due to their metallic/semiconducting characteristic, as an additive to a polymer matrix, CNTs could lead to a low electrical percolation threshold so that the polymer could obtain an sufficient electrical conductivity to realize an electrostatic discharge [5]. In addition, for high-temperature applications, the high thermal conductances of CNTs provide the thermal transport needed to reduce material operating temperatures and improve thermal shock resistance even at low volume fractions [4].

Materials used for the aeronautics applications are usually supposed to be strong, light and thermal stable. As what is discussed before, CNTs contain almost all good properties that the aeronautics engineering is looking for. With a low volume or weight fraction, the CNTs can improve the mechanical and thermal properties of their host matrix significantly. With the CNT additive, the aeronautics structures could be smaller, lighter but stronger. The simulation and experimental studies on the micro and Nano structures of the Nano-composite materials would reveal the physical nature of the function of CNTs in their host matrix to guide the fabrication of the CNT reinforced Nano-composite materials. The study on CNT reinforced Nano-composite materials, especially with ceramic and metal matrix, will open a door leading to the next generation of aeronautics materials and to promote the whole industry.

References

1. Wu B, Wang Z, Gong QM, Song HH, Liang J (2008) Fabrication and mechanical properties of in situ prepared mesocarbon microbead/carbon nanotube composites. Mater Sci Eng 487: 271-277.
2. Wang Q (2009) Atomic Transportation via Carbon Nanotubes. Nano Letters 9: 245-249.
3. Wu N, Wang Q (2012) Ejection of DNA Molecules from Carbon Nanotubes. Carbon 50: 4945-452.
4. Curtin WA, Shelton BW (2004) CNT-reinforced ceramics and metals. Materialstoday 7: 44-49.
5. Bauhofer W, Kovacs JZ (2009) A review and analysis of electrical percolation in carbon nanotube polymer composites. Composites Science and Technology 69: 1486-1498.

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Received November 21, 2012; **Accepted** November 23, 2012; **Published** November 25, 2012

Citation: Wu N (2012) Carbon Nanotubes Reinforced Nano-Composite Materials and Their Application in Aeronautics Engineering. J Aeronaut Aerospace Eng 1:e119. doi:10.4172/2168-9792.1000e119