Effect of Atomic Interconnects on Percolation in Single-Walled Carbon Nanotube Thin Film Networks

By: Tian, XJ (Tian, Xiaojuan)[1,3] ; Moser, ML (Moser, Matthew L.)[2,3] ; Pekker, A (Pekker, Aron)[2,3] ; Sarkar, S (Sarkar, Santanu)[2,3] ; Ramirez, J (Ramirez, Jason)[1,3] ; Bekyarova, E (Bekyarova, Elena)[2,3] ; Itkis, ME (Itkis, Mikhail E.)[2,3] ; Haddon, RC (Haddon, Robert C.)[1,2,3,4]

View ResearcherID and ORCID

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Abstract

The formation of covalent bonds to single-walled carbon nanotube (SWNT) or graphene surfaces usually leads to a decrease in the electrical conductivity and mobility as a result of the structural rehybridization of the functionalized carbon atoms from sp(2) to sp(3). In the present study, we explore the effect of metal deposition on semiconducting (SC-) and metallic (MT-) SWNT thin films in the vicinity of the percolation threshold and we are able to clearly delineate the effects of weak physisorption, ionic chemisorption with charge transfer, and covalent hexahapto (eta(6)) chemisorption on these percolating networks. The results support the idea that for those metals capable of forming bis-hexahapto-bonds, the generation of covalent (eta(6)-SWNT)M(eta(6)-SWNT) interconnects provides a conducting pathway in the SWNT films and establishes the transition metal bis-hexahapto organometallic bond as an electronically conjugating linkage between graphene surfaces.

Keywords

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Author Information

Reprint Address: Haddon, RC (reprint author)

+ Univ Calif Riverside, Dept Chem Engn, Riverside, CA 92521 USA.

Addresses:

+ [1] Univ Calif Riverside, Dept Chem Engn, Riverside, CA 92521 USA
+ [2] Univ Calif Riverside, Dept Chem, Riverside, CA 92521 USA
+ [3] Univ Calif Riverside, Ctr Nanoscale Sci & Engn, Riverside, CA 92521 USA
+ [4] King Abdulaziz Univ, Dept Phys, Jeddah 21589, Saudi Arabia

E-mail Addresses: haddon@ucr.edu

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