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Double Layer Charging for Conductivity Enhancement of Pure Metallic and Semiconducting Single Wall Carbon Nanotubes[1]

NATHANAEL MAYO, ALEXANDER KUZNETSOV, ANVAR ZAKHIDOV, Nanotech Institute - University of Texas at Dallas — Injecting high electronic charge densities can profoundly change the optical, electrical, and magnetic properties of materials. Evidence suggests a possibility of significantly improving conductivity of carbon nanotubes through double layer charge injection. Double layer charge injection can prove to be a powerful method when applied to carbon nanotubes because of theirs high surface area and chemical stability. Investigation has commenced on the effect of charging on various types of carbon nanotubes, specifically 99% purified single wall semiconducting and single wall metallic tubes. An electrical double layer is electrochemically introduced upon a sheet of carbon nanotubes via application of potential (up to ±5 volts) to a sample immersed in ionic-liquid-based electrolyte. Resistance of carbon nanotube as a function of applied charging voltage is recorded to determine the effects of charge injection. Results show that the electrical double layer considerably reduces the resistance across both samples. ESR/LFMA studies combined with low temperature magnetic and transport measurements are conducted to search for charge injection induced superconductivity in carbon nanotubes.

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