# Transport properties of semiconducting and metallic single-walled carbon nanotubes thin films

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Understanding the conduction mechanisms in single-walled carbon nanotubes (SWCNTs) is crucial for their use in various applications, such as transistors and conductive films [1]. Furthermore, the interaction of charge carriers in SWCNTs is interesting from the fundamental point of view [2-4].
In this study, we used aqueous two-phase extraction technique [5,6] to achieve high purity separation of SWCNTs by type of conductivity. As parent material we used "Tuball" nanotubes with an average diameter of 1.8 nm. Thin films with different metallic/semiconducting ratios were prepared. Measurements of resistance were conducted in wide temperature range (from 300 K down to 1.6 K) (Fig.1). At low temperatures current-voltage characteristics were also measured.
We observed variable range hopping conductance mechanisms with different dimensionality for semiconducting films and for films with the presence of semiconducting nanotubes. For pure metallic SWCNTs and for SWCNTs doped with CuCl [7] we found the conduction mechanism is similar to Tomonaga-Luttinger behavior. For single-walled carbon nanotubes doped with copper chloride we observed power law behavior in transport with Luttinger parameter $\alpha = 0.43$.

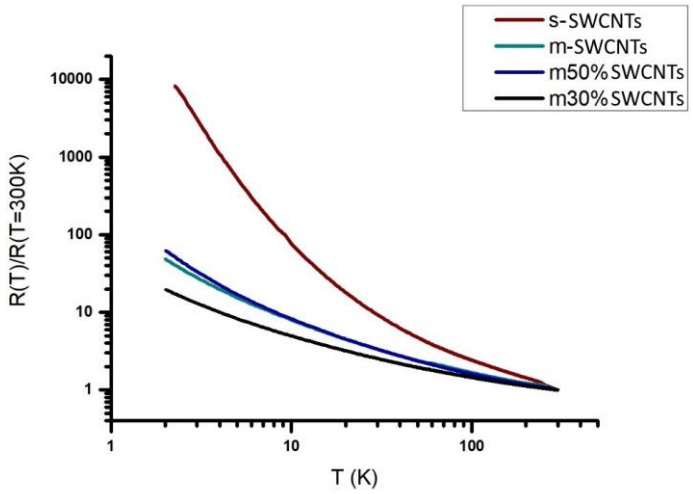


*Fig.1. Normalized resistance of four different samples with different metallic/semiconducting ratios as a function of temperature, 98% semiconducting SWCNTs (brown), 98% metallic SWCNTs (light blue), 50% metallic SWCNTs (navy), 30% metallic – parent SWCNTs (black).*

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