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Electrical Contacts to Nanotubes and Nanowires

FRANÇOIS LÉONARD, Sandia National Laboratories

Electrical contacts play a key role in electronics. As new materials such as nanotubes and nanowires are explored for nanoelectronics, the fundamental aspects of electrical contacts need to be re-examined due to the unique properties of these nanostructures. In this talk, recent theoretical and modeling results will be presented on the properties of electrical contacts to carbon nanotubes and nanowires. For these quasi-one dimensional (Q1D) structures, side contact with the metal only leads to weak band realignment, in contrast with bulk metal-semiconductor contacts. Schottky barriers are much reduced compared with the bulk limit, and should facilitate the formation of good contacts. However, the conventional strategy of heavily doping the semiconductor to obtain Ohmic contacts breaks down as the nanowire diameter is reduced. The issue of Fermi level pinning will also be addressed, and I will discuss how the unique density of states of Q1D structures makes them less sensitive to this effect. The results agree with recent experimental work, and should apply to a broad range of Q1D materials.