EFFECT OF CONTACT INTERFACES ON QUANTUM CONDUCTANCE OF ARMCHAIR NANOTUBES

S. Krompiewski
Institute of Molecular Physics, Polish Academy of Sciences,
ul. M. Smoluchowskiego 17, 60-179 Poznań, Poland

9.7 cm

Effect of contact interfaces, between metallic single-wall carbon nanotubes (SWCNT) and external electrodes made also of nanotubes, on the electrical conductance is studied. A tight-binding model with both diagonal and off-diagonal disorder, a recursive Green function technique as well as the Landauer formalism are used. The studies are carried out within the coherent transport regime and are focused on: (i) SWCNT's length effects, (ii) evolution from conductance quantization to resonant tunneling, and (iii) magnetoresistance. It is shown that the so-called on-resonance devices, i.e. nanotubes having a conductance peak at the Fermi energy, occur with a period of 3 carbon inter-ring spacings. In the presence of strongly modified contact interfaces, the on-resonance lengths may differ from what is deduced from energy spectra of finite isolated (not coupled to electrodes) SWCNTs. The present approach elucidates the role of mismatch of band structure parameters at sample/electrode interfaces and shows that disorder at the contact interface acts as an energy barrier responsible for electron confinement. Additionally, this theory provides an insight into magnetoresistance dependence of SWCNTs on conditions at the contact interface.

13.4 cm

Subject category :

2. Magnetic Films, Surfaces and Multilayers

Presentation mode :
oral

Corresponding author :
S. Krompiewski

Address for correspondence :
Institute of Molecular Physics, Polish Academy of Sciences,
ul. M. Smoluchowskiego 17, 60-179 Poznań, Poland

Email address :
stefan@ifmpan.poznan.pl