Towards Supersensitive Bolometers and Electron Coolers Based on Carbon Nanotubes

M.Tarasov[1,3], J.Svensson[2], S.Dittmer[2], L.Kuzmin[1], and E.Campbell[2]

[1].*MC2, Chalmers University of Technology, SE 41296 Göteborg, Sweden*

[2]. *Dept. of Physics, Göteborg University, SE-41296 Göteborg, Sweden*

[3]. *Institute of Radio Engineering and Electronics, 125009 Moscow, Russia*

E-mail: Mikhail.tarasov@mc2.chalmers.se

Carbon Nano Tubes (CNT) are being intensively developed for novel electronics. Electron cooling by superconductor-insulator-nanotube (SIN) tunnel junctions could be extremely effective due to the small volume of the CNT. Cold-Electron Bolometer with a CNT as absorber should demonstrate record sensitivity due to the very low temperature that is predicted to be reached in the CNT (less than the phonon temperature). Objectives of this work are to demonstrate effective electron cooling in superconducting nanostructures comprising a CNT; and to develop a supersensitive Cold-Electron Bolometer (CEB) based on a cooled carbon nanotube as absorber. We have made a first attempt to develop a carbon nanotube cold electron bolometer CNTCEB. A prototype of a generic layout was designed and masks were fabricated. First samples with SWCNT show that with this technique we can connect a CNT to electrodes by SIN tunnel junctions. When measuring in a 3-probe mode we observed two barriers, one at about 2eV corresponds to Al and another at about 0.5eV corresponds to the CNT. Single wall nanotubes grown using chemical vapour deposition presumably contain many defects and as a result they have a high resistance and a single electron tunneling mechanism with a typical Coulomb blockade features measured at temperature about 300 mK. The measured resistance of the semiconducting single-wall CNT is too high for practical applications but further progress is expected with metallic multiwall CNT and ropes of such tubes.