GROWTH OF CARBON NANOTUBES ON METALLIC SUBSTRATES AND STUDY OF THEIR INTERFACIAL TRANSPORT PROPERTIES

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ABSTRACT

The goal of this work was to identify suitable metal/alloys on which multiwalled nanotubes (MWNTs) can be grown directly. This thesis discusses the growth of carbon nanotubes (CNTs) on metallic substrates by using vapor-phase catalyst delivery in a chemical vapor deposition (CVD) technique. The major restriction for the growth of CNTs is that the growth is carried out mainly on non-conducting substrates, which causes major limitations to various nanotube based electronics applications where one end should be electrically conducting.

Growing CNTs directly on to metal helps in to eliminate various issues related to integrating CNTs with device such as defining electrical contacts, scalability, site selective growth and the flexibility of the substrate to have desirable geometrical shape and configuration. Thus, the present work will focus on the following aspects of MWNT-metal based architectures, namely: 1) The study of the fundamental aspect of direct growth of CNTs on metal substrates and to explore other conducting substrate material for the growth of CNTs. 2) The study of growth kinetics, the growth mechanism of CNTs on these conducting substrates, and the interaction of the catalyst with these substrates. 3) Characterization of interfacial contact resistance (electrical and thermal), between the nanotubes and the substrate which is a bottleneck for electrical and thermal transport and has application in nanoelectronics, thermal management etc. 4) Explore the applications of CNT-metal based systems involving field-emitter devices and supercapacitors, where the CNTs are well anchored to the Inconel substrate and thus show low contact resistance.