New Developments in Nanoscale Science at Oak Ridge National Laboratory

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1. The Center for Nanophase Materials Sciences: A Partnership with Universities

Oak Ridge National Laboratory (ORNL) has been selected by the Department of Energy to develop, together with university partners, a highly collaborative and multidisciplinary *Center for Nanophase Materials Sciences* (CNMS). The Center will create synergies needed to ensure the use of unique ORNL and university research capabilities to rapidly advance knowledge of nanoscale materials, phenomena and structures, and will provide a multidisciplinary research and learning environment for the education of scientists. The Center will include a Nanofabrication Research Laboratory, a Nanomaterials Theory Institute, and extensive facilities for materials synthesis and characterization. The location of the CNMS at ORNL will facilitate the use of the intense neutron beams at the upgraded High Flux Isotope Reactor and the new Spallation Neutron Source, for fundamental studies of the structure and dynamics of nanomaterials. A planning workshop for the CNMS will be held in Oak Ridge during late October to obtain detailed input from the scientific community regarding the Center's equipment needs, research focus areas, and desired operational characteristics.

2. Growth of Carbon-Based Nanomaterials [1, 2]

The second half of this talk will present highlights of current ORNL research that focuses on understanding and controlling the growth of single-walled carbon nanotubes (SWNTs) and vertically aligned carbon nanofibers (VACNFs). For SWNTs, *in situ* time-resolved measurements during pulsed-laser vaporization, as well as *ex situ* annealing experiments, imply that SWNT synthesis occurs by the condensed-phase conversion of carbon clusters or nanoparticles that is catalyzed by metal nanoparticles (diameter < 20 nm) during extended annealing periods. Several aspects of the deterministic growth of VACNFs by plasma enhanced chemical vapor deposition will be discussed, with particular emphasis on the effects of growth conditions on VACNF shape and alignment.

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[2] Research carried out by A. A. Puretzky, D. B. Geohegan, V. I. Merkulov, A. V. Melechko, D. H. Lowndes, M. A. Guillorn, and M. L. Simpson.