

# Foreword to the Special Issue: Proceedings of the Fourth Workshop on SWCNT Growth Mechanisms Organized by NASA-JSC, Rice University and the Air Force Research Laboratory

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Received: 31 August 2009

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The great potential of single-walled carbon nanotubes (SWCNTs) is limited by our inability to produce them in large quantities and consistently make available tubes of specific type. A better understanding of nucleation and growth mechanisms of SWCNTs is a first major step in that direction. The biennial series of growth mechanisms workshops (GMW03, 05, 07) conducted by NASA Johnson Space Center and Rice University brought together the world's experts in the field of nanotube synthesis and advanced this effort based on experiments, theory, and modeling. The Air Force Research Laboratory of Dayton co-sponsored the latest GMW09 workshop which was held at the Tierra Sagrada (Guadalupe River Ranch) in Boerne, TX during April 17th–21st, 2009.

The workshop was attended by about 90 participants specializing in the production and modeling of SWCNTs. The keynote lecture by Neal Lane, former Assistant to the President for Science & Technology and University Professor at Rice University, discussed the current energy policy and how new technologies can compete with old ones by providing more efficient methodologies and novel materials. A variety of topics crucial to SWCNT nucleation and growth were presented in 27 invited talks and 23 poster presentations, the majority of them related to the chemical vapor deposition (CVD) process. Control of diameter and length seem

to be possible with proper selection of production conditions such as catalyst preparation, carbon feedstock, and surface modifications with reactive gas etching. The role of other gas phase species such as  $O_2$ ,  $H_2$ , and  $H_2O$  in the growth of mats and aligned SWCNTs was discussed. A possible mechanism for nanotube growth termination by Ostwald ripening was presented which seems to explain some of the observed non-linear growth rates. Computations of the energetics of cap formation and tube elongation were also presented. Modeling of catalyst-carbon interactions indicates sustained growth when the metal is pushed to the surface. Similar to the previous workshops, the “wrap up session” provided stimulating discussions of the status of the “Crucial Questions in SWCNT Nucleation and Growth”. One new question that could be added to that partially answered list is how to monitor and remove defects during growth.

All presenters were invited to send manuscripts to the journal *Nano Research* and this special issue is a collection of eight papers that were accepted after a rigorous peer review process. A follow-up workshop is planned for 2011 with a new sponsor, Oak Ridge National Laboratory.

Special thanks go to the organizing committee members and to the international advisory committee members for their continued support and



suggestions. Prof. Pasha Nikolaev helped with the peer review process of the workshop proceedings.

### **Organizing Committee of the Fourth Workshop on SWCNT Growth Mechanisms**

Dr. Benji Maruyama, Dr. Ruth Pachter, and Ms. Sandy Miller: Air Force Research Laboratory, Dayton, OH, USA

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