Guadalupe Workshop VII

Proposal for Support of the
Rice University -- Air Force Research Laboratory – NASA Workshop
– on –
Single Wall Carbon Nanotube Nucleation and Growth Mechanisms
April 10-14, 2015

SUMMARY: WHO, WHAT, WHEN and WHY, and HOW YOU CAN GET INVOLVED

On March 12, 2015, the National Nanotechnology Initiative (NNI) published the results of a technical meeting: "Realizing the Promise of Carbon Nanotubes: Challenges, Opportunities, and the Pathway to Commercialization," held at the National Aeronautics and Space Administration (NASA) Headquarters on September 15, 2014. The report covers what the world has come to expect from carbon nanotubes (CNTs) – their high strength, light weight and highly tunable conductivity, their usefulness as resonators and sensors and their great promise in a large number of materials applications. These promises were part of what the late Rick Smalley was talking about when he said "Be a Scientist – Save the World.

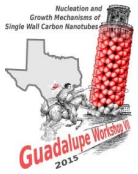
This report highlights the biggest challenges to converting the promise of carbon nanotubes into commercial reality. Most of those challenges revolve around theory – getting a better understanding of how CNTs grow – and practice – using that understanding to manufacture CNTs at lower cost, with higher quality and more specific charactieristics.

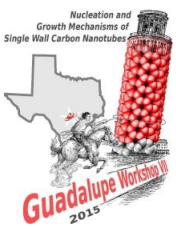
These challenges are precisely what the Guadalupe Workshop seeks to meet by convening its worldwide team every second year.

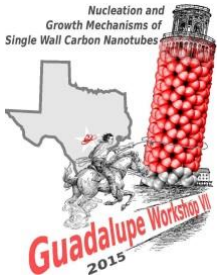
Since 2003, Rice University, the Air Force and NASA have organized and run the Guadalupe Workshop on the Nucleation and Growth of Single-Wall Carbonn Nanotubes (SWCNTs). These every-other-year, invitation-only workshops take place in the Texas Hill Country and bring the leading SWCNT experts from around the world to talk openly about their latest progress and greatest challenges in basic research. Over the years, the workshop has added many partners– for example, Oak Ridge National Laboratory, the Honda Research Institute and others – and has been funded primarily by Federal and private donations, along with attendance fees.

With Federal and corporate budgets under pressure, the funding for the workshop has become more difficult in 2013 and 2015, just at the time when the work has become most critical.

On one hand, twelve years seems like a long time to search for any "holy grail" in technology. On the other hand, even with massive government and industry efforts to shorten the pathway from ANY technology discovery to its highest and best commercial use, that time line still takes 20-25 years. **This means that right now we are in perhaps the most critical stages of making carbon nanotechnology promises into reality**.







Looking at the NNI proceedings mentioned above, of the 17 topics that that report recommends for research, the Guadalupe Workshop either covers or touches significantly on six. Moreover, it is a plain truth that, until we uncover the ways to produce SWCNTs in large quantities, at low costs, whith pre-determined length, width, electrical conduictivity, etc., we will not be able to meet ANY of the major commercialization goals. In other words, **the Guadalupe Workshop works on the most important keys to the whole carbon nanotechnology enterprise.**

This year, for Guadalupe Workshop VII, we are asking for YOUR financial support and attendance. If your corporate goals include making use of Single-Wall Carbon Nanotubes, we ask that you consider seriously supporting and participating in this event.

Following is a table of sponsorship levels, plus a link to further detail.

Sponsorship Program – Further Detail in Appendix

Available to ALL sponsors – may distribute collateral, submit poster for poster session, have logos on workshop materials, have table-top space for demos, etc. (cont'd)

Diamond - $20,000

Platinum - $10,000

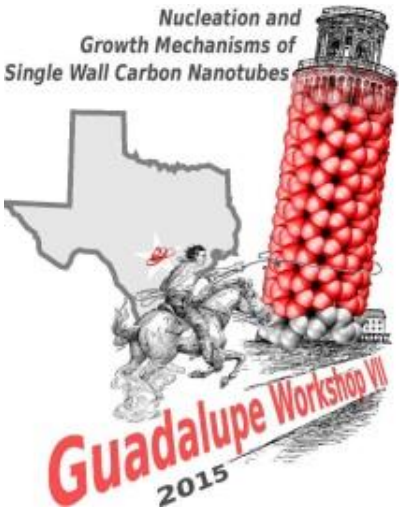
Gold - $5,000

Silver - $1,000 – primarily for smaller companies

Bronze - <$1,000 – primarily for very small companies

Additional naming opportunities for any sponsor who has already committed to one of the above:

- Meals - e.g. "This Dinner Sponsored by ___" - $1,000 for a lunch, $2,000 for a dinner
- Student Sponsorship - e.g. "Five students' entry fees sponsored by ___" at a price of $500 each



Links to More Information

DETAILS

The Richard E. Smalley Institute for Nanoscale Science and Technology of Rice University through the Smalley-Curl nanoCarbon Center, the Air Force Research Laboratory (Materials and Manufacturing Directorate,) NASA Johnson Space Center are planning to host the seventh international workshop on single-wall carbon nanotube (SWCNT) nucleation and growth mechanisms. Following the great success of the first two workshops held in 2003 and 2005 at the Guadalupe River Ranch in Boerne, TX, the third workshop in 2007 held at the Canyon of the Eagles, in Burnet, TX near San Antonio, the fourth workshop in 2009 again at the Guadalupe River Ranch, and the fifth and sixth Guadalupe Workshops in 2011 and 2013 held at the Flying L Ranch in Bandera, Texas, we are committed to the seventh workshop, again to be held at the Flying L Ranch in Bandera. A donation for support of the workshop is requested to help fund the expenses of the meeting, including travel expenses and lodging and meals (per diem) of invited speakers, the cost of the meeting room (audio/visuals and room rental) and other miscellaneous expenses. An estimate of these meeting expenses is attached in Appendix I. Acknowledgment of the support from the sponsors will be given in the workshop web site, in the meeting printed program, during the workshop, as well as in any proceedings published and in a final report. See Appendix II for benefits and levels of support.

Purpose of the Workshop

The purpose of the workshop is to continue to develop a better understanding of SWCNT nucleation and growth mechanisms. The workshop will bring together ~100 of the world's top experts to present experiments, theory, and modeling efforts focused on all aspects of SWCNT nucleation, growth and production. Substantial progress has been made in the years since the very first workshop, especially in the controlled CVD growth of SWCNT carpets/forests, but also in the theoretical/computational modeling of growth processes. It is important that new

developments be understood and disseminated to the nanotube growth community. Sufficient understanding of the growth mechanisms should enable better production methods of SWCNT in particular and carbon nanotubes in general. Likewise, there is continued high interest in producing SWCNTs of a single chirality. As we did in the previous workshop, we will also include a session on emerging related work on graphene and on boron nitride nanotubes. It is hoped that both researchers and developers will benefit from this open scientific exchange, resulting in new nanomanufacturing (commercial) methods to produce SWCNTs of specific chirality and characteristics.

Background

The great potential of single-wall carbon nanotubes (SWCNTs) is limited by our inability to produce large quantities at reasonable costs. The development of a reliable source of large quantities of SWCNTs depends on better production methods. However, the nucleation and growth mechanisms of single-wall carbon nanotubes are still not well understood. This has limited the development of production of methods to produce large quantities of SWCNTs, including the laser ablation/oven technique, the arc vaporization process, and chemical reaction methods such as the high-pressure carbon monoxide disproportionation (HiPco) and chemical vapor deposition. This workshop will address the scientific issues and knowledge of nucleation and growth mechanisms that could lead to improved production methods and the ability to selectively produce SWCNTs of particular types, with high purity. The workshop will bring together, for the seventh time, the world's experts in the field of nanotube synthesis and processing to present their latest understanding, based on experiments, theory, and modeling. Continuing the process of identifying and refining the "Top Ten Problems" at each meeting, the sixth workshop (see attached report) identified several key areas for recommended expansion of activity. However, it is felt that no one, as yet, has sufficient understanding of the mechanisms to be able to translate this into optimum production methods. This workshop will be organized around fundamental issues and areas of new interest, and yet will still allow for entirely new thinking. We will also invite a very few speakers to include relevant topics related to graphene and BN nanotubes. It is hoped that through this continuing scientific exchange, knowledge will be synthesized to give funding agencies, researchers and developers the insight necessary to develop efficient and commercially viable SWCNT production methods and programs.

Attendees and Invitees

As in the previous workshops, world experts in various aspects of SWCNT nucleation and growth will be invited to give reviews and critiques of the current knowledge of various growth mechanism concepts. The invitee list and the Scientific Steering Committee have been expanded appropriately to include authors of new work reported in the past two years. Others researchers who are working in the area will be invited to attend and give poster discussions. Persons from industry who are involved in SWCNT production will also be invited. In addition, despite the high technical content of the presentations and discussion, we expect to have a few representatives from support organizations, such as specialty equipment companies, venture capital and legal firms.

Workshop Format

Opening Plenary Session on Friday evening featuring a prominent expert in the broad field – in past workshops we had luminaries such as Nobelists Rick Smalley and Bob Curl, Neal Lane (former NSF Director and Presidential Science Advisor,) Phaedon Avouris (IBM), and Brent Segal (Lockheed Martin).

Invited talks on specific topics.
Extended discussion following talks.
Contributed posters and a short poster-preview session.
Time is allotted for open forum discussions at the end of each session, to help wring out clearer insights into SWCNT nucleation, growth and production. A summary list of issues and action items will be prepared during each open forum discussion by the session rapporteurs.
A final discussion period will synthesize all the issues and action items, revising the Top Ten List, and will conclude the workshop.

Workshop Proceedings

The organizers will prepare a short summary of the conclusions, issues, and action items from the workshop, along with a copy of all presentations. These will be distributed only to participants and sponsors.**The organizers will also prepare an overview of the proceedings that is edited to be appropriate for public viewing, and will provide this overview to corporate and government funding sources.**

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Appendix I: Estimated Itemized Expenses

Cost Estimates per Attendee Type			Food & Lodging, parsed	
	Transpor-tation Subsidy	Food & Lodging, 4 days‡§	Lodging /day	Meals /day
Intern'l Speakers§	1,100.00			
US Speakers§	500.00			
Food and lodging costs for all‡§		500.53	97.88	27.25
COSTS	**Estimated**			
Intern'l Speakers	11			
Estimated % needing travel subsidy	75%			
Intern'l Speakers Needing Travel Subsidy	8			
Travel subsidy for International Speakers	$ 8,800			
US Speakers	13			
Estimated % needing travel subsidy	50%			
US Speakers needing subsidy	7			
Travel subsidy for Domestic Speakers	$ 3,500			
Estmated travel subsidy for organizers	$ 500			
Total attendees (estimated)	90	Assuming this is minimum, per contract		
Food and Lodging for all	$ 45,048			
Extra night's stay for 3 people	$ 375			
Subtotal - room, board & Spkr trnsprt'n		$ 57,723		
Org. & misc	$ 1,000			
Van rental and fuel#	$ 1,000			
Meeting Room, Coffee, AV, etc.	$ 2,084			
Entertainment	$ 2,838			
Binders and name tags	$ 1,300			
Sandy Miller	$ 4,100			
Tee shirts @ $10/person	$ 900			
Subtotal: Workshop Requirements		$ 13,221		
Grand Total Expenses		$ 70,944		
‡ Flying L charging only double-occupancy rates for 2015				
# San Antonio to Flying L and return				
§ Assumging four nights and days for majority of travelers - managing extra nights by exception				

Appendix II: Sponsorship Program

Available to ALL sponsors

- May bring items for distribution – literature, samples
- Can submit a poster for the poster session
- Logos/names displayed on website and all printed materials, reports, and presentations
- Table-top space for demonstration, display

Sponsorship levels:

Diamond - $20,000

- Meeting naming benefit – The Seventh Rice – NASA – AFRL – **COMPANY** – Guadalupe Workshop…
- Five persons may attend at no extra charge – total value of $2,500
- Logo printed and displayed prominently, in jumbo size
- Company name on the Plenary Reception and social event

Platinum - $10,000

- Three persons may attend at no extra charge – total value of $1,500
- Logo printed and displayed prominently, in large size
- Company name on the Poster Reception

Gold - $5,000

- Two persons may attend at no extra charge – total value of $1,000
- Logo printed and displayed – still prominently, but slightly smaller than for Platinum

Silver - $1,000 – primarily for smaller companies

- One person may attend at no extra charge – value of $500
- Logo printed and displayed – prominently, slightly smaller than for Gold

Bronze - <$1,000 – primarily for very small companies

- Logo printed and displayed prominently

Additional naming opportunities for any sponsor who has already committed to one of the above:

- Meals - e.g. "This Dinner Sponsored by ___" - $1,000 for a lunch, $2,000 for a dinner
- Student Sponsorship - e.g. "Five students' entry fees sponsored by ___" at a price of $500 each

If donating directly to Rice University for the workshop support, please make checks out to:

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and send to:

John Marsh
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