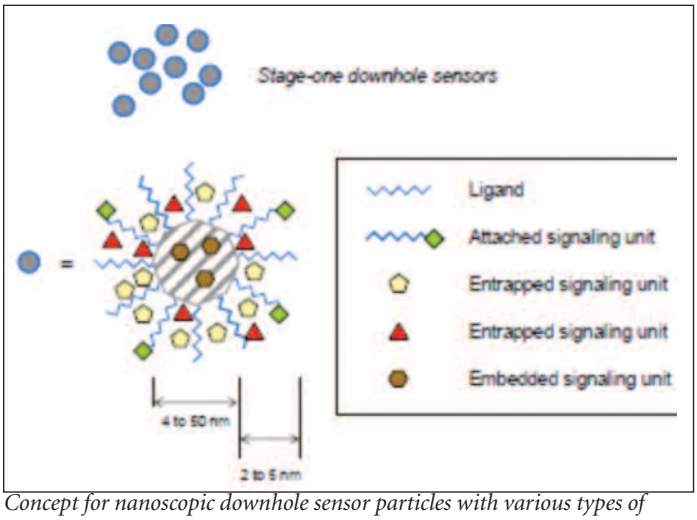
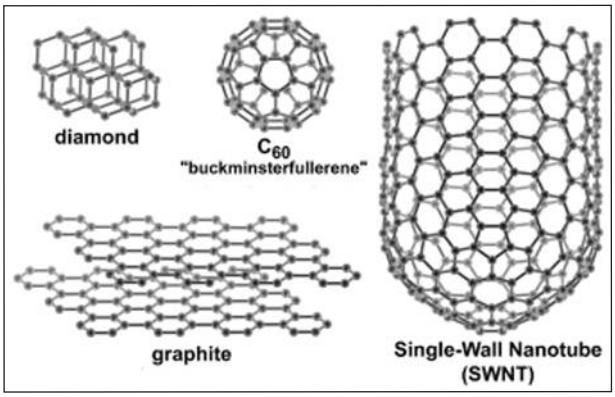
SIPES September Luncheon Meeting
Nanotechnology in the Oil Patch

Dr. Wade Adams, *Director of the Richard E. Smalley Institute for Nanoscale Science and Technology at Rice University*

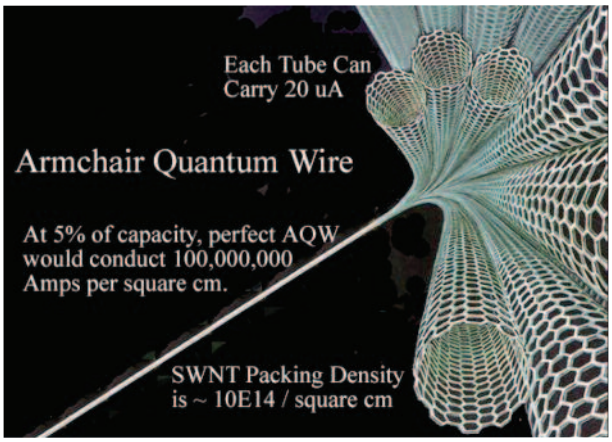


Concept for nanoscopic downhole sensor particles with various types of signaling units incorporated for tailorable sensing and reporting functions. (Courtesy of Jim Tour, Rice University)

Nanotechnology is a discipline in its third decade, but application of nanotech to the oil and gas industry has only recently begun. The first Society of Petroleum Engineers workshop focusing on nanotech was in February of 2008 in Dubai. There are two more scheduled for 2010. The Advanced Energy Consortium, funded by ten major oil and gas companies, began operations in January of 2008. It now has more than ten basic research projects underway. They concentrate on nanotech downhole, looking at fundamental interactions of nanoparticles in rock formations and at possible ways to interrogate formations and to report on physical and chemical conditions away from the borehole.



Diamond and graphite were the common forms of carbon until the discovery of the buckyball (C60) molecule in 1985, followed by the carbon nanotube in 1991.



Concept of an ordered and oriented fiber of single wall carbon nanotubes, which can conduct very large amounts of electrical current. This would enable a much more powerful grid, and smaller electrical motors and generators.

Those who missed the talk last month may find this 'a little' interesting.

There are many other areas of potential impact of nanotech on the energy industry, including light-weight applications of nanocomposites, durable and corrosion-resistant coatings, catalysts, membrane filters, insulation materials, electrical conductors, batteries, sensors, fluid additives, elastomers, etc. Nanotech will likely offer incremental and revolutionary changes to most technologies in upstream and downstream business. The energy industry lags behind the aerospace, medical, electronics and transportation industries in exploring the breadth and depth of nano applications. Energy companies can adopt and adapt nanotech innovations from these other industries, provided that they employ or train nano-knowledgeable scientists and engineers.

Nanotechnology at Rice University has been huge since the discovery of the "buckyball" in 1985 and the Nobel Prize that followed in 1996 to Rick Smalley and Bob Curl at Rice. The Richard E. Smalley Institute, following the death of Smalley in 2005, now advocates and supports research and education in nanotech with over 140 faculty members in sixteen different departments. Major areas of emphasis include nanomaterials, nanobiology, nanophotonics, nanoelectronics, nanoenvironmental research, nanotech in energy, and outreach to the public. Research in all these areas is important and all receive substantial funding. However, research in energy was considered by Rick Smalley to be both the single **SIPES Luncheon** *continued on page37*

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most important problem facing humanity today and a magnificent scientific and technical opportunity. Rick's vision of a long-term future energy system transporting energy around the world as electrons on a smart, high-capacity world-wide grid system can only be realized by a revolution in nanotech. Solving the world's energy and climate challenges will demand revolutionary breakthroughs in the physical sciences and engineering. Nanotechnology offers unprecedented opportunities for new physical and chemical properties to meet those challenges. ■

Biographical Sketch

Dr. Wade Adams is the Director of the Richard E. Smalley Institute for Nanoscale Science and Technology at Rice University. The Smalley Institute is devoted to the development of new innovations on the nanometer scale by coordinating and supporting nanoscience and nanoengineering research of over 150 faculty members. Some current thrusts include research in conventional and renewable energy, carbon nanotubes, nanoporous membranes, molecular electronics and computing, and diagnostic and therapeutic medical applications of buckyballs and nanoshells. The Smalley Institute is part of a major initiative at Rice to expand research activities in nano, bio, info and energy and environmental science and engineering.

Dr. Adams retired from the US Air Force senior executive ranks in January 2002, as the Chief Scientist of the Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson Air Force Base, Dayton, Ohio. Dr. Adams was educated at the U.S. Air Force Academy, Vanderbilt University, and the University of Massachusetts.

For the past 40 years he has conducted research in polymer physics, concentrating on structure-property relations in high-performance organic materials. He is internationally known for his research in high-performance rigid-rod polymer fibers, X-ray scattering studies of fibers and liquid crystalline films, polymer-dispersed liquid crystals, and theoretical studies of ultimate polymer properties. He has written more than 200 publications on these topics, including several review articles and two edited books, has four patents (one licensed), and has given over 700 technical presentations. He is a Fellow of the American Physical Society and the Air Force Research Laboratory. Dr. Adams also retired from the Air Force Reserve in the rank of Colonel in 1998.