

'Be an engineer, save the world!'



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Texas chicken wire may hold the answers to many of our industry's technological problems and to our worker shortage too.

Attention all drillers, engineers, contractors and operators! Would you like drillpipe, casing and tubulars made out the toughest, lightest material ever known to the universe? What about "smart dust" that acts as both a detector and transmitter that can be sprinkled in your well to monitor and transmit downhole conditions?

Does this sound like science fiction? Well it's not quite yet a reality, but it's also not as far away as you might think.

Dr. Wade Adams, director of the Center for Nanoscale Science and Technology (CNST) at Rice University in Houston, was the featured speaker for the opening-day lunch at the American Association of Drilling Engineer's (AADE) annual technology conference ("Drilling Solutions for the Future") held in March 2005, in Houston. He gave an entertaining and provocative discussion on nanotechnology, then challenged those present to join in the effort to bring this revolutionary technology to a commercial reality.

What is nanotechnology?

In a very general sense, nanotechnology is the ability to create and manipulate matter at the molecular level which makes it possible to create materials with improved properties, such as lightweight and ultra-high strength, and greater capabilities such as electrical and heat conductivity (can you think of any applications for the energy industry?).

One of the basic materials for nanotechnology is the C_{60} molecule, which Adams put in simple terms that many of us folks in the room could understand: Texas chicken wire, the open mesh fencing used to make chicken coops.

The molecular structure of a graphene sheet, which is graphite like in a pencil, looks like Texas chicken wire (Figure 1). According to Adams, "The sheet nature of graphite is slippery and soft so it comes off on the paper when you write. But take that graphene sheet and curl it up into a tube, say on a 30° angle from either horizontal or vertical, and you get the strongest material that we think we'll ever have available to work with in the universe. That's a pretty amazing transformation."

"Now you don't make the nanotube by rolling the sheet into a tube; that's how you understand the structure of the carbon nanotube. You actually get the carbon to grow that way off of

metal particles."

Adams refers to the work of Dr. Richard Smalley, founder of the CNST and co-discoverer of C_{60} , along with Harold W. Kroto and Robert F. Curl, who all won the 1996 Nobel Prize in Chemistry for their discovery.

They were able to produce stable clusters with 60 carbon atoms which happen to be the exact pattern of a European football (US soccer ball) which was also the same structural shape as a building designed by American architect R. Buckminster Fuller. They named their discovered C_{60} molecule structure after him, *buckminsterfullerene*, which was nicknamed the "buckyball" (Figure 2).

Later experiments showed that buckyballs could be expanded into tubular strands called fullerenes or nanotubes.

A call to the energy industry

Adams' call-to-action is for much more participation from the energy industry. He explains there is some limited research and participation from some of the companies, but it's a long way from what is needed to make nanotechnology a commercial reality.

He said, "Nanotechnology holds the key to make so many of our existing technologies more pervasive, more distributed, more integrated. How's that going to happen? We don't really know yet. It's going to take a lot of clever people and time to do that. But it's a field that's wide open. And if we can excite kids to want to tackle these interesting problems, it's going to be really exciting."

At the end of his presentation, Adams splashes his last two slides: "Be a scientist — save the world. Be an engineer — save the world."

Our industry is facing a critical skilled-worker shortage. Due to the cyclical nature of our business and our often unflattering public image, we wonder how to attract people to our industry. Nanotechnology is the next big thing, and our industry can, should and must be a part of it. The answers are within our grasp. Let's pick up the buckyball and run with it.

For more information, see <http://cnst.rice.edu>. **E&P**

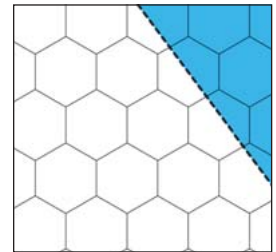


Figure 1. The atomic structure of the C_{60} molecule resembles Texas chicken wire.

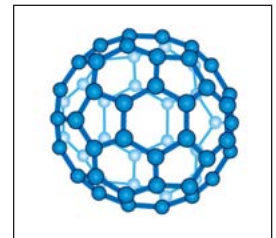


Figure 2. The C_{60} molecule, which resembles a soccer ball, has been nicknamed the buckyball. (Images courtesy of American Scientist)