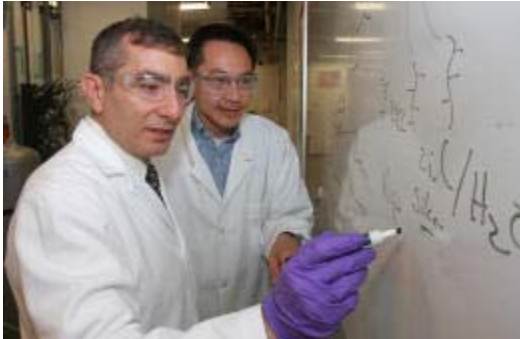


## A new way to get inside scoop on oil

### Super-tiny robots may be deployed for big strikes of tomorrow

By TOM FOWLER HOUSTON CHRONICLE

May 17, 2009, 9:08PM



Gary Fountain For the Chronicle

Rice's Jim Tour and Michael Wong discuss the nanobot project.

#### Resources

#### PAYING BIG BUCKS TO THINK SMALL

Ten energy companies have put up a total of \$30 million for early research to build nano-scale devices to help analyze oil and gas reservoirs. The Advanced Energy Consortium includes Baker Hughes, ConocoPhillips, Halliburton, Marathon and others.

Big Oil is thinking small — really, really small — in its quest to squeeze more oil and gas from the ground.

A consortium of companies is funding research at Rice University, the University of Texas and other schools around the country to develop tiny devices 70,000 times smaller than the width of a human hair to gather information about oil and gas reservoirs deep underground.

Trillions of the minuscule hydrophilic carbon clusters, informally called “nanobots,” would be injected into geologic formations thousands of feet in the ground and then pulled back to the surface. Changes to the chemical makeup of the nanobots would tell petroleum geologists valuable information about the reservoir.

The technology and the techniques are still in the early development stages, but researchers and the companies funding them have high hopes they could give a more complete picture of the complex underground structures where hydrocarbons hide.

Almost half of the oil that's discovered is never recovered with current technology, so even an improvement of 5 to 10 percent would be significant, said Rosemary Hornbrook, a petroleum engineer with BP, one of the consortium members.

“You're talking big oil there,” she said.

Oil doesn't sit under the ground in large caves just waiting for a giant man-made straw to slurp it out. Rather it's enmeshed in various types of porous rock and sand.

#### Static pictures

Companies now have three types of tools they use to assess where oil and gas is located underground: core samples from drilling sites, readings from sensors placed in the wells and seismic data gathered by shooting sound waves through the earth and recording the echoes.

There are constant improvements with the technologies, such as the development of powerful computer software that creates three-dimensional images of reservoirs based on seismic data. But these are still relatively rough, static pictures that don't provide much information about items like temperature, pressure, permeability and chemical makeup of a formation.

“Ultimately you're trying to build a model for how things will flow through the reservoir,” said John Ullo, a researcher with Schlumberger, another consortium member. “There are a lot of uncertainties, yet we base hundreds of millions of dollars of business decisions on these uncertainties.”

**Jim Tour**, a professor at Rice University known for cutting-edge work in the field of nanotechnology — which involves the engineering of atomic-scale devices — said the devices under development would be like secret agents sent behind enemy lines, but without a radio to transmit messages. (Here's a [Rice briefing paper](#) on nanotechnology)

“You don't get the information until the agent actually comes back and you interrogate him,” Tour said.

And instead of just one or two agents, trillions of nanobots would travel below, carried in drilling mud or some other medium. The nanobots would have different molecules attached that react in different ways with oil,

water, sulfur or other materials.

When brought back to the surface the nanobots would be analyzed for changes that could tell geologists something about the reservoir they passed through, such as the temperature or pressure, the presence of sulfur or other chemicals.

### **Works in the lab**

Tour and his colleagues have built the nanobots, demonstrated their ability to hold on to the molecules that will help in the analysis and put them through soil samples in the lab. The next step will be to make the nanobots move through drill core samples.

Given the recent resurgence of interest in renewable energy sources and Congress and the White House pushing hard for legislation to put a price on carbon dioxide emissions, jumping through high-tech hoops to squeeze more oil out the ground may seem unnecessary, maybe even counterproductive.

But most projections of world energy use through 2050, even those with aggressive goals for the growth of renewables, still have hydrocarbons like oil and gas continuing to be major fuel sources.

More: Read SciGuy blog entries on nanotechnology [here](#).

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