Rice University rolls out new nanocars (Videos)

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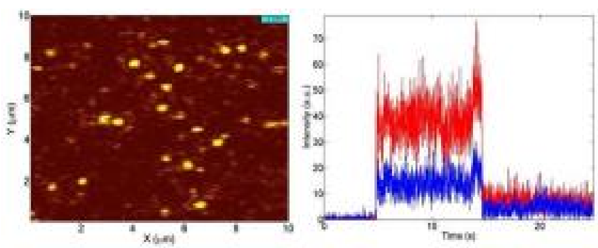

Single Molecule Imaging of Molecular Machines

This year's model isn't your father's nanocar. It runs cool.

The drivers of Rice University's nanocars were surprised to find modified versions of their creation have the ability to roll at room temperature. While practical applications for the tiny machines may be years away, the breakthrough suggests they'll be easier to adapt to a wider range of uses than the originals, which had to be heated to 200 degrees Celsius before they could move across a surface.

The nanocar was a sensation when introduced in 2005 by the lab of James Tour, Rice's Chao Professor of Chemistry and a professor of mechanical engineering and materials science and computer science.

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A paper on the new research published this month in *ACS Nano* was authored by Link; Tour; Anatoly Kolomeisky, associate professor of chemistry and chemical and biomolecular engineering; postdoc Guillaume Vives; graduate students Saumyakanti Khatua and Jason M. Guerrero; and undergraduate Kevin Claytor.

"We thought, 'We're just going to take an image, and nothing's going to happen,'" said Link of the team's initial success in attaching fluorescent dye trailers to the nanocars. "We were worrying about how to build a temperature stage around it and how to heat it and how to make it move.

"To my surprise, my students came back and said, 'They moved!'"

Sure enough, time-lapsed films monitoring an area 10-by-10 microns square showed the cars, which appear as fluorescing dots, zigging and zagging on a standard glass slide. Link said the cars moved an average 4.1 nanometers (or two nanocar lengths) per second.

"It took us another year to quantify it," said Link, noting as key the development of a new tracking algorithm by Claytor that will be the subject of a future paper.

The simplest technique for finding moving nanocars was precisely the way astronomers find distant cosmic bodies: Look at a series of images, and the dots that move are winners. The ones that don't are either fluorescing molecules sitting by themselves or nanocars stuck in park.

The dye - tetramethylrhodamine isothiocyanate - had the added attraction of emitting a polarized signal. Since dye molecules tended to line up with the chassis, the researchers could always tell which way the cars were pointed.

Link hoped cars with dye embedded into the chassis can be built that would eliminate the drag created by the fluorescent trailer. He speculated that putting six wheels instead of four on a nanocar could also help keep it moving in one direction, much like a tank with treads.

"Now that we see movement, the challenge is to take it to the next level and make it go from point A to point B. That's not going to be easy." Creating nanotracks or roads may be part of the solution, Link said.

All the research is directed at the ultimate goal of building machines from the bottom up in much the same way proteins are built to carry out tasks in nature.

"In terms of computing, having these single molecules be addressable is a goal everybody wants to reach," said Link. "And to understand and emulate biophysics and biomechanics, to build a device based on what nature gives us, is of course one of the dreams of nanotechnology."

Related story: Rice scientists attach motor to single-molecule car: www.physorg.com/news64081416.html

More information: The paper can be found at www.pubs.acs.org/doi/abs/10.10 … nk&searchHistoryKey=

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