NANOCAR

Penn State MRSEC

Four-wheeled nanocars move back and forth on a gold surface along the direction defined by their axles. In contrast, three-wheeled nanotripods simply spin in place.

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A smooth ride on fullerene wheels

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In MRSEC-sponsored research, Kevin Kelly, Andrew Osgood, Yasuhiro Shirai, James Tour and Yuming Zhao at Rice university have produced a nanometer-scale car with fullerene wheels that rotate about axles and guide the motion of the nanocar across a substrate. The nanocar, synthesized in Tour's group, is composed of a single organic molecule with four C_{60} molecules as wheels, mounted on freely rotating axles and attached to a central chassis. The entire vehicle is only a bit wider than a strand of DNA.

In addition to the synthetic tour de force, a key advance in this research was demonstrating that the wheels actually roll, rather than slide. If the cars simply slid across the substrate, then they would skid equally well in all directions. By observing the nanocars with a scanning tunneling microscope, Kelly and Osgood demonstrated that the cars move back and forth perpendicular to their axles more easily than they move side to side. In other words, the fullerene wheels have traction and keep the cars on track. In a second test, an alternative tripod-shaped "vehicle," with three axles all pointing outwards from a central core, simply spins in place.

Future goals in nanovehicular research include installing a light-driven engine in the car, and designing a nanotruck that is capable of carrying payload.