shape of such minute particles is, however, difficult. Now, Stefan Vajda, Larry Curtis and colleagues at Argonne National Laboratory have created supported platinum catalysts formed from clusters of only eight to ten atoms that can be up to 100 times more active than conventional catalysts.

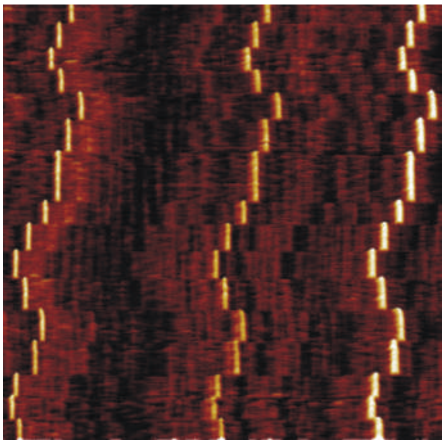
Methods for producing size-selected platinum clusters from beam sources, which are then deposited on supports that stabilize the clusters, are relatively well-established. However, the catalytic activity of these clusters has not previously been investigated under realistic conditions. The Argonne team tested their cluster catalysts on the oxidative dehydrogenation of an alkane (propane, C_3H_8) to create the corresponding alkene (propene, C_3H_6), by forming a new carbon–carbon double bond in the molecule. Using quantum chemical calculations, they were also able to assign the high reactivity of the clusters to the under-coordination of the platinum atoms.

The researchers expect that these results could lead to a new class of catalyst capable of bond-specific chemistry, though scaling up the production of size-selected clusters using more conventional chemical methods will be a challenge.

CARBON NANOTUBES

Pinch me

Phys. Rev. Lett. **102,** 025501 (2009)



Nanotubes are pristine systems and so have remarkable electrical properties, but they are also interesting mechanical objects. Young's modulus — a measure of stiffness — is in the terapascal (TPa) range for nanotubes, which is at least several times higher than steel. Most stiffness measurements on nanotubes, however, are done by pulling them along their long axis. Measurements of resistance to 'pinching' have given values of radial Young's modulus that vary over three orders of magnitude.

Now, Bernardo Neves and colleagues at the Universidade Federal de Minas Gerais have rationalized this large spread in values. Rather than assuming a constant radial Young's modulus, as is often done, their model allows it to vary as a function of radial strain. As a result, the model shows that a simple function of three variables (the applied force, the radius of the forcing tip and the original nanotube radius) is a universal quantity for any single-walled carbon nanotube.

When strain is plotted against this function, rather than against deformation, scattered experimental data collapses onto a single line. In addition, knowledge of all but one of the variables in the universal quantity will allow experimentalists to calculate, rather than measure, the remaining variable.

NANOMANUFACTURING

A closer look

Environ. Sci. Technol. doi:10.1021/es8023258 (2009)

The demand for nanotechnology is rapid, and this growth comes with concerns about health risks and environmental burdens such as energy use, global warming and depletion of resources. Researchers at the US Environmental Protection Agency now report that increasing trends in nanomanufacturing could impact energy consumption and global warming during the life cycle of the product, and that more needs to be done to fill the knowledge gaps.

David Meyer and co-workers examined products in the Woodrow Wilson database and found that 55% of nanoproducts are in the health and fitness category, and that children's goods is the largest growing sector followed by automotive products. Silver, which is known for its antimicrobial properties, emerged as a major element in use — followed by carbon and titanium, which are common components in composites and sunscreens, respectively. A comparison of existing data for life-cycle assessments (analysis of the environmental impacts of a product) of different materials showed that carbon-nanofibre production and the semiconductor industry were the most energy intensive sectors. This can be important because it is related to fossil-fuel consumption and the generation of greenhouse gases.

Although the trends show high energy consumption and a tendency towards global warming, many of the nanomanufacturing processes are still far from optimized, and so more needs to be done in this area and in refining the framework for assessment.

The definitive versions of these Research Highlights first appeared on the *Nature Nanotechnology* website, along with other articles that will not appear in print. If citing these articles, please refer to the web version.

Top down Bottom up

Change of direction

Why did a device that was built in a university stop working when it was moved to a company lab?

It was in a Denver restaurant that Richard Knochenmuss of Novartis first suggested to Akos Vertes of George Washington University (GWU) an experiment that forms the basis of a recent paper (*Angew. Chem. Int. Ed.* **48,** 1669–1672; 2009). Vertes and colleagues had been working on laser-induced silicon microcolumn arrays (LISMAs). A laser can efficiently ionize fragile biomolecules adsorbed onto the surface of these arrays, allowing them to be analysed by mass spectrometry.

The work had attracted the interest of Protea Biosciences, but when the arrays were tested in Protea's company lab, they were orders of magnitude less effective than they had been at GWU. Vertes and co-workers suspected that the arrays were acting similarly to directional antennas, and that the reduced performance was due to differences in the incident light angles used.

Knochenmuss heard about the results at a meeting of the American Society for Mass Spectrometry in Denver and suggested that the GWU team vary the polarization of the incident light to check their hypothesis. The results confirmed that the antenna analogy was correct: the ion yield was high when the planes of polarization and incidence where parallel, but virtually zero when they were perpendicular. The LISMAs, therefore, behave as nanophotonic ion sources that can be switched on and off by changing the laser polarization.

For Matthew Powell, director of research and development at Protea, the friction created when an academic idea encounters a commercial environment can drive a project forward. "Academic ideas often experience an element of surprise as [they] do not always seem to work universally," he explains, adding that the LISMA project benefited from simply being in a new neighbourhood. "Foreign lab environments and instruments helped us identify unknowns for the LISMA plates and their operation."

Vertes agrees: "Be prepared for surprises, but stay the course when they come."