US researcher changes properties of gold

Physicists at the University of Rochester in New York have found a way of changing the properties of gold – and other metals – so as to render them literally black.

Non-reflective materials are extremely useful in radiation gathering sensors, as they minimise losses that affect ordinary metal-based detectors. Another important application is chemical catalysis in fuel cells.

A new thermal ablation process devised by Rochester scientists Chunlei Guo and Anatoliy Vorobyev involves exposing metals to femtosecond pulses of intense laser light, which create randomly-organised and periodic nanoscale structures on their surfaces.

Guo reports that there has been much interest from the industry, and a number of companies are looking into licensing the technique.

The researchers' laser concentrates as much power as the entire North American grid onto a spot the size of a needle point, using a device powered from a standard mains outlet.

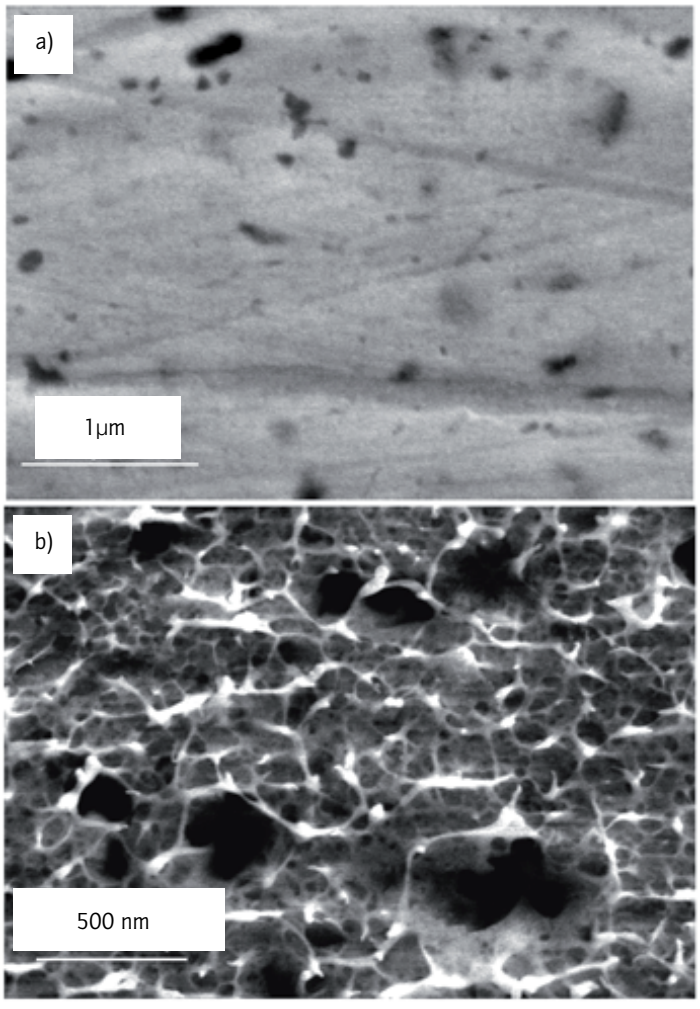
The radiation blasts the metal surface, forming pits, globules and strands that massively increase the surface area of the material, leading to the absorption of virtually all incident light.

The laser ablation process is slow, taking around 30 minutes to roughen a single square centimetre strip of metal, but the researchers are looking to improve the technique through the use of different laser pulse lengths, wavelengths and intensities.

The motivation behind the research was to understand in detail laser-matter interactions at high radiation intensities.

'We did the first measurements of energy deposition following femtosecond laser ablation and found a lot of energy remained in the target,' says Guo. 'Our results then prompted us to examine metal absorptance.'

Scanning electron microscope images of a gold surface (a) before irradiation and (b) after a single 60-femtosecond laser pulse of intensity 1.1 J/cm^2



Source: AY Vorobyev & Chunlei Guo, Applied Physics A, 86, 321 (2007)

Click here for more about Chunlei Guo's research group

Fullerenes penetrate healthy skin

Researchers at North Carolina State University have shown that a repetitive flexing motion increases the rate at which nanoparticles are absorbed through skin.

The ability of nanoparticles to pass through human tissue makes them highly effective as drug delivery agents, but it also poses a potential health and safety risk in the workplace.

Dermatology expert Nancy Monteiro-Riviere, working with graduate student Jillian Rouse and US Rice University chemist and materials scientist Andrew Barron, made the discovery after exposing skin to a peptide called phenylalanine-based fullerene amino acid, or Bucky amino acid.

The experiment was conducted by placing pieces of pig skin, which has physiological and structural similarities to human skin, on a machine that repeatedly flexes the samples for either 60 or 90 minutes. Fullerene absorption was then measured eight hours after exposure, and again at 24 hours.

Skin flexed for 90 minutes shows evidence of fullerene penetration through to the inner dermal layer after 8 hours of fullerene exposure, whereas control specimens show the particles concentrated mainly in the outer epidermis, with only a small amount in the dermis after 24 hours of exposure.

Rather than pass through skin cells, the fullerenes appear to pass between the cells in the

