ACHIEVING ADVANCED MICRON-SCALE PROTOTYPING

Dr David Sarphie describes how a University-founded consultancy can offer new ways of helping industry to access university research and resources in order to facilitate knowledge transfer and increase competitiveness.

When Professor Richard Feynman famously declared "There's plenty of room at the bottom" in his now-classic talk to the American Physical Society at Caltech in late December 1959 introducing the concepts of nanotechnology, he speculated, among many other things, about the possibility of fabricating a car of infinitesimal proportions.

Feynman suggested that a manufacturing accuracy of about 4/10,000 of an inch (or roughly 10µm, if the conversion calculation I found on the internet is to be trusted) would be needed to arrive at a car of his design. Indeed, he questioned why it was not already possible, in a post-Sputnik, pre-Apollo world, to drill holes to such tolerances.

While manufacturing techniques for so-called microelectromechanical systems (MEMS) have developed out of the micro-electronics industry over the intervening decades, providing engineers and scientists with the ability to manufacture to micron-scale tolerances, these techniques have largely been labour-intensive, multi-stepped approaches and not necessarily suitable for truly rapid prototyping.

Now Bio Nano Consulting (BNC), the specialist bionanotechnology product development consultancy, has expanded its capabilities for advanced prototyping in this field with the commissioning of just such a laser micro-machining system for fabricating features down to 5 microns in almost any solid material.

The new system facilitates BNC's rapid prototype fabrication capability for commercial organisations developing microfluidics and other novel biomedical applications of nanotechnology.

Housed within BNC's new Imperial College London laboratories, the Oxford Lasers E-series laser micro-machining system is the latest asset in an investment of over £50m in facilities and equipment that backs BNC's world-leading product development capabilities.

Commenting on the investment, Bio Nano Consulting CEO, Dr David Sarphie said, "Access to state-of-the-art tools such as this allows us to improve the prototyping services we already offer our customers, enabling us to address our customers' needs rapidly and cost-effectively."

The new system can drill, cut and mill materials including silicon, glass, plastic, ceramic and metal with micron-level accuracy. With increasing numbers of biomedical products and technologies dependent on sophisticated microfluidic systems, interest is expected to be high in healthcare product development organisations.

Microscopy Focus

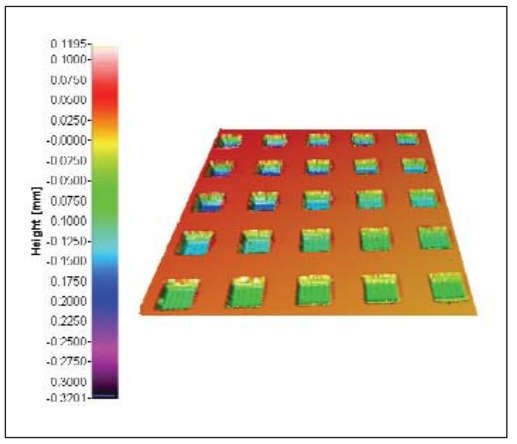

Figure 1. Optical profile image of etched silicon substrate, with an array of 25 squares ablated at differing laser movement speeds and differing numbers of repeats of the square (Courtesy of Dr Richard Winkle, Bio Nano Consulting and Imperial College London)

That has changed with the introduction of laser micro-machining (also called laser ablation). This system uses laser light itself to remove material from a solid such as silicon, glass or plastic. At high laser power the laser light converts the material to a plasma (or ionised gas) which then dissipates.

This method, which facilitates the direct, rapid fabrication of prototypes on the micron-scale, is now being used in the medical field for prototyping medical devices, diagnostic tests, and developing new analytical methods such as microfluidics.

A key benefit of this new 'direct-write' technology is that an engineer can input a design via computer-aided design (CAD) software in the evening and return the following morning to find the completed functional prototype (something that is generally not possible with conventional lithographic techniques).

BNC is a specialist research and development consultancy operating in the convergent field of bionanotechnology. A joint venture of Imperial College London and University College London, BNC is funded through the Technology Strategy Board (TSB) with additional support from the London Development Agency (LDA).

Along with its partner organisation, the National Physical Laboratory, BNC offers a service to the biomedical and healthcare industries in microsystems and nanotechnology. This encompasses design, 3-D modelling and visualisation, rapid prototyping, and characterisation.

With the advent of such new enabling technologies we are moving ever closer to realising Feynman's dream of micron-scale fabrication and an infinitesimal car...although filling the bloody thing up is still likely to cost an arm and a leg.

For more information please visit: www.bio-nano-consulting.com

> ***There's Plenty of Room at the Bottom***
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> *Feynman, R.P., "Engineering and Science", February, 1960, www.zyvex.com/nanotech/feynman.html*

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