Designer nanomaterials caught by laser octopus

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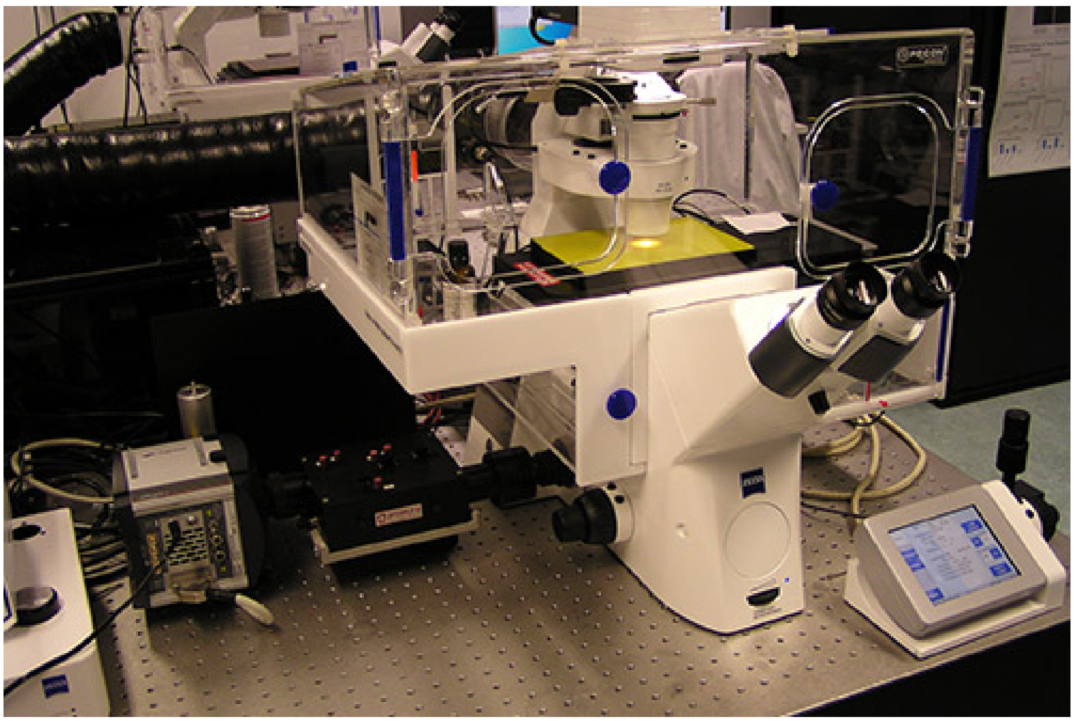

LSF Super-resolution microscope

UK researchers have discovered a new way of observing designer nanomaterials – materials 400 times smaller than a human hair.

The breakthrough has the potential to revolutionise the way nanomaterials are applied to medicine and catalytic chemical reactions, for example in designing ever smaller drug transporters.

The project involved researchers from the University of Bristol working with a team from the Science and Technology Facilities Council's Central Laser Facility. The research, published in the journal *Science*, explains how two-dimensional nanomaterials, called platelet micelles, can be identified using the super resolution imaging of the STFC's microscope facility 'Octopus'.

Platelet micelles consisting of three concentric rectangles, each incorporating fluorescent dyes of a different colour and with a central hole, can be easily seen in a fluorescence microscope. However, because the rectangles are about 200 nm thick, they appear blurred and overlapping.

"A conventional microscope cannot resolve multicolour objects on this scale but the structured illumination microscope within 'Octopus' is ideally suited to imaging objects between 100 and 300 nanometres in size. These discoveries are the first use of super-resolution techniques in this type of materials science research. The work opens the doors to being able to image a whole range of new materials that previously could not be observed effectively at high resolution," said Dr Stephen Webb, from STFC's Central Laser Facility (CLF).

The paper reports that these micelles have a highly controllable structure and are easily assembled into larger structures.

This, and the fact that they are easily functionalised, makes them a potential tool for a wider range of uses, including therapeutic applications and catalysis. For example, the circulation time of drug delivery vehicles in the body is dependent on their size and morphology. These features can be controlled in these micelles and the platelets can also be functionalised to contain medically relevant molecules.

Professor Ian Manners led the team from the University of Bristol's

School of Chemistry. He said: "The characterisation using the super resolution imaging capability at the CLF was absolutely critical to the success of this work. Without the extra resolution that Octopus offered us, the internal structure of the micelles would not have been clear at all."

More information: H. Qiu et al. Uniform patchy and hollow rectangular platelet micelles from crystallizable polymer blends, *Science* (2016). DOI: 10.1126/science.aad9521

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