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CAMBRIDGE SOCIETY FOR THE APPLICATION and
APPRECIATION of RESEARCH

Soft, Small and Interesting

Soft Matter; towards Soft Nanotechnology

Prof. Ullrich Steiner FRS
Department of Physics, the Cavendish Laboratory

7.30 p.m., Monday 23rd October, 2006
The Wolfson Lecture Theatre, Churchill College, Storey's Way, Cambridge

Professor Steiner Writes:

Pattern formation processes have intrigued scientists for more than a century and continue to be the subject of intensive research. With the ability to control structure formation processes on smaller and smaller length scales, on one hand, and building-up molecular structures by self-assembly, on the other hand, scientists are gaining access to a tool-box of methods that allow to engineer the morphology and structural properties from the nanometre scale to macroscopic dimensions.

The main theme of this talk is the control of physical mechanisms that give rise to the spontaneous formation of patterns. Examples of such process are the de-mixing of liquids, which gives rise to a characteristic phase morphology; surface patterns which arise from instabilities that are triggered by capillary waves; and the self-assembly of macromolecules. The objective of our research is to (1) discover and understand the nature of pattern formation processes, (2) to find means to interact with these processes, to be able to control the patterns that emerge, and to (3) employ this control to engineer films and surfaces with specific functionalities.

Examples of this approach include the manufacture of anti-reflective coatings, super-hydrophobic surfaces, patterned ceramics (e.g. high Tc superconductors), biomometic organic crystal composites, and organic-inorganic composite materials with structures on the 10 nm length scale.

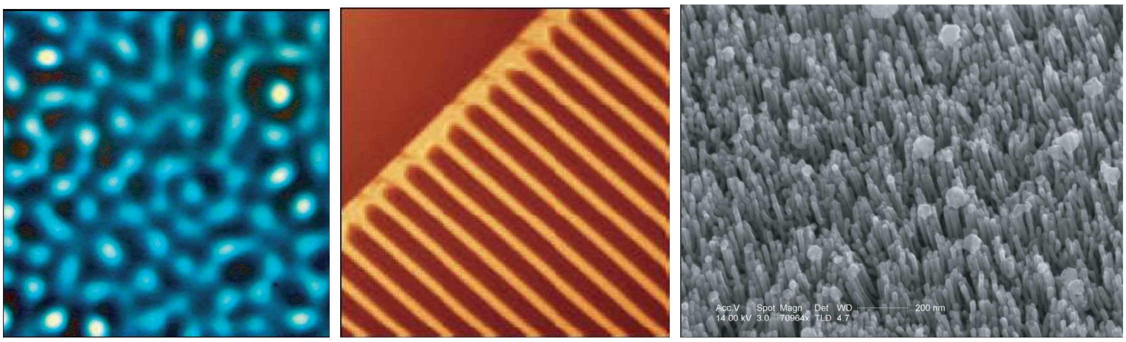

Figure 1: The control of the capillary surface patterns in (a) can be used to lithographically replicate 100 nm-wide stripes in (b). Self-assembled morphologies in (c) were employed to manufacture 300nm long and 10 nm wide ceramic rods.

About the Speaker:

Ullrich Steiner studies micro- and nanoscale pattern formation processes that take place at surfaces and in thin films. The controlled creation of structures on small length scales is essential for many applications. Examples include the manufacture of semiconductor chips (current pattern size ~100 nm), displays, and bio-chips, but also surfaces with special properties such as anti-reflective coatings, self-cleaning surfaces, *etc*. In addition to the applied aspects listed above, the study of pattern formation processes is very sensitive to forces that act at surfaces and interfaces. From a fundamental point of view, he studies phenomena that take place at liquid surfaces or in thin films to gain information about interactions that are relevant on molecular and mesoscopic length scales.

He recently moved from the University of Groningen to take up the John Humphrey Plummer Professorship of Physics of Materials at the University of Cambridge. He also holds the Raymond and Beverly Sackler Prize for Physical Sciences, awarded by the University of Cambridge

The Organising Secretary adds.....

Nanotechnology is one of these sciences which is about to 'hatch'; rather like biotechnology 20 years ago. I am interested to know what is likely to emerge from the egg when it does hatch; this lecture should provide us with some ideas

I am also looking for a **Vote of Thanks** for Professor Steiner's lecture! If you are interested, please contact me (richard.freeman@genericsgroup.com or by leaving a message on 01799 5325 948) if you would like to volunteer (make sure I have your contact details).

It has been suggested that I recruit Chairs and VoTs to a greater extent from amongst our membership – so here's your chance!

Best Regards

Richard Freeman
CSAR Organising Secretary

Coffee available, as usual, in the foyer outside the lecture theatre from ~7.00 p.m.