ZERNIKE INSTITUTE COLLOQUIUM

Thursday, April 2nd, 2015

16:00h, Lecture Hall: 5111.0080 **Coffee and cakes from 15:30h**

Templated self-assembly of Block Copolymers and Multiferroic Oxide Nanocomposites

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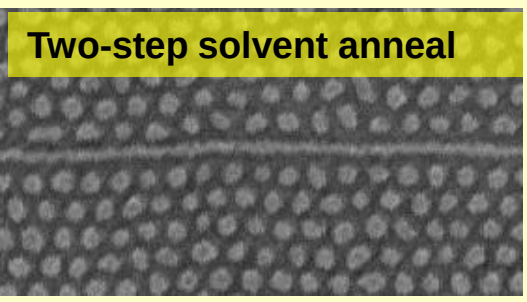
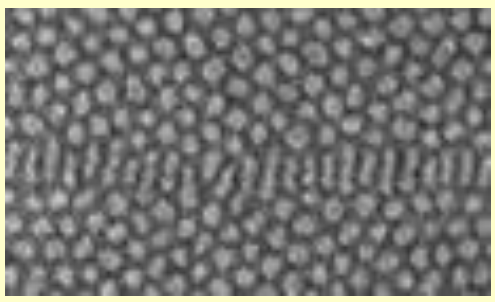
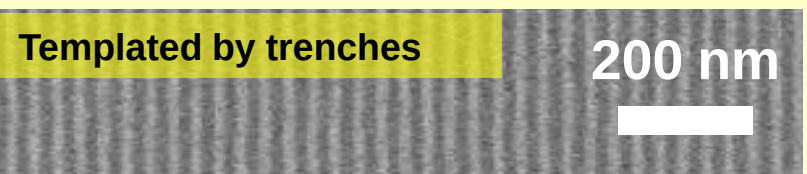
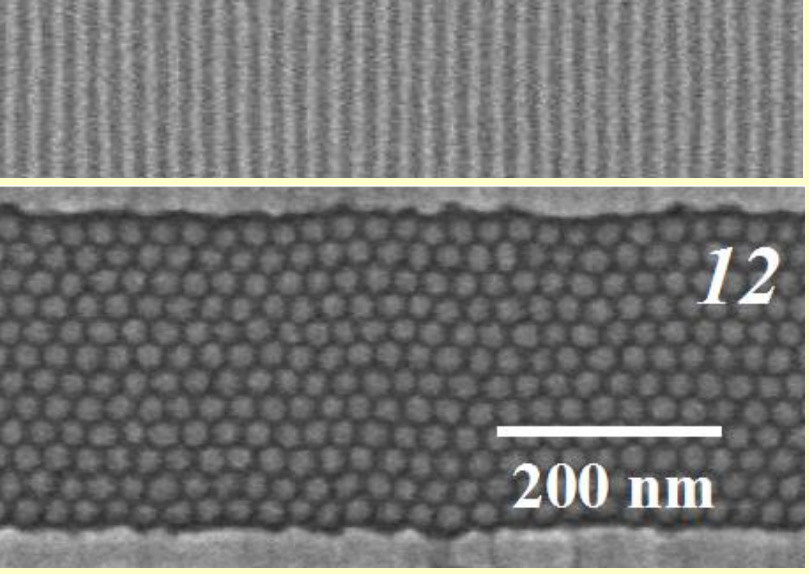


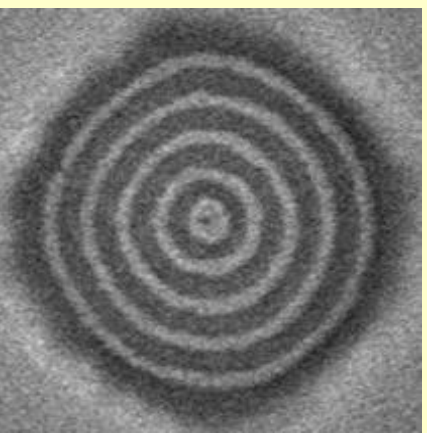


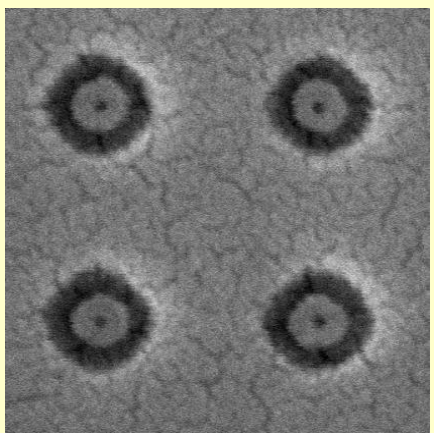
Templating of the locations and orientations of self-assembled features is key to enabling a range of nanoscale processes and devices. We discuss here the directed self assembly of two very different thin film systems: vertical epitaxial oxide nanocomposites and block copolymers. This illustrates the science underpinning the design of templates based on their interactions and commensurability with the self-assembling system. Codeposition of immiscible oxides on a single crystal substrate can produce two-phase nanocomposite films in which each phase grows epitaxially on the substrate, forming columnar structures with well-defined vertical interfaces. The periodicity of the pillars is determined by kinetic factors including surface diffusivity and the flux of deposited material. We describe the templated self-assembly of spinel/perovskite (Co, Ni or Mg) Fe2O4/BiFeO3 nanocomposites to form both periodic and aperiodic arrangements with period of ~40 nm and above, directed by substrate pits made by focussed ion beam or etching, and the resulting properties of the nanocomposite.

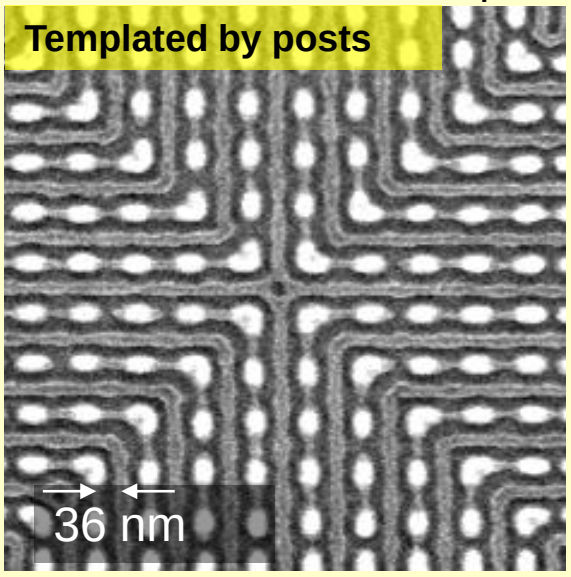
In contrast, block copolymers microphase separate with a characteristic periodicity governed by the length of the polymer chains, producing patterns useful for next generation nanolithography. Templating strategies based on substrate topography are used to make complex arrangements of dots, lines and spaces and 3D cross-point structures from diblock co-polymers or to form arrays of square-symmetry and Archimedean tiling patterns from linear or star triblock terpolymers, accomplished by solvent and solvothermal annealing for processing times from seconds to hours. The resulting patterns can be used as masks to fabricate various nanoscale devices.

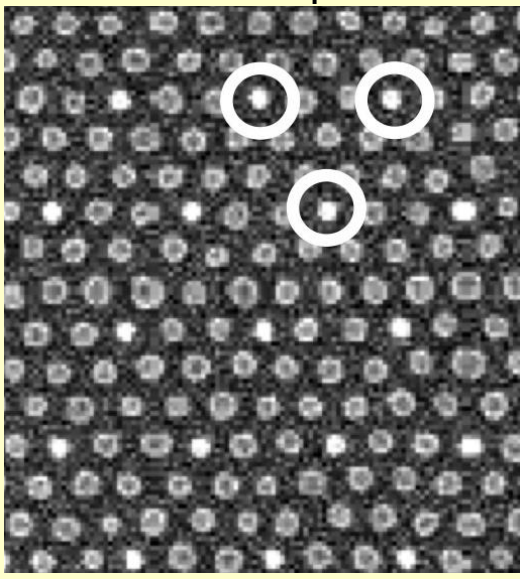


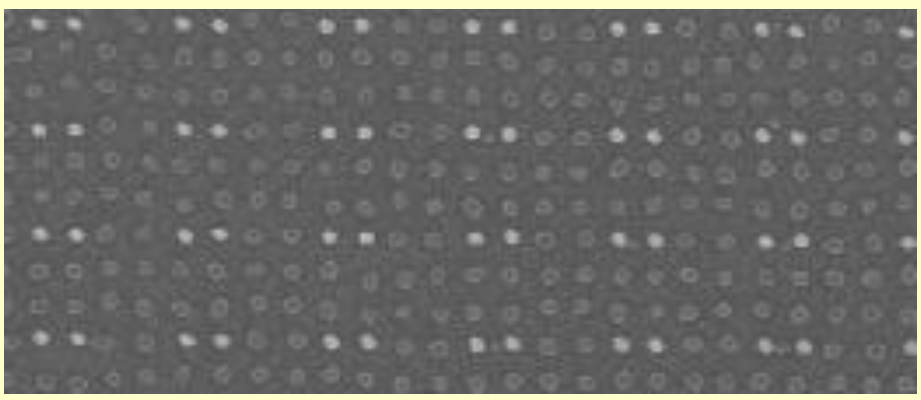












Science 321 939 (2008), Nature Nanotech. 5 256 (2010), Nat. Comms. (2014)

Nano Letts 8 2975 (2008)

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