Materials News

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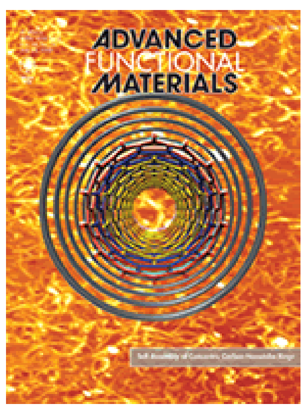
Links

Self-assembled gradient concentric rings of carbon nanotubes
(Advanced Functional Materials)



Credit: Advanced Functional Materials

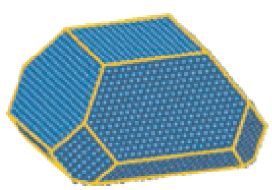
Researchers have recently demonstrated a simple and straightforward method to create gradient concentric rings of carbon nanotubes over very large surface areas by combining two consecutive self-assembly processes. Hundreds of gradient concentric polymer rings with remarkable regularity were spontaneously formed on Si substrates via evaporation-induced self-assembly of polymer in a confined geometry consisting of a sphere on a flat Si substrate. The concentric polymer rings on the Si were then exploited as a chemically patterned surface to guide the formation of multiwalled carbon nanotube (MWNT) rings (i.e., directed self-assembly). Specifically, a drop of water-dispersed MWNTs mixed with poly (diallyl dimethylammonium) chloride (PDDA) was cast on the surface of the template polymer rings. The periodically alternating hydrophobic polymer rings and hydrophilic Si substrate (i.e., Si rings) provided different wettabilities for the MWNT/PDDA solution. As water evaporated, the MWNT solution dewetted the polymer rings while forming MWNT rings on the Si rings. The combination of spontaneous evaporation-induced self-assembly and subsequent directed

self-assembly offers a new means of patterning microscopic CNT rings over large areas. This method is fast and cost-effective, eliminating the need for multistage lithography and externally applied forces.
[*Directed Self-Assembly of Gradient Concentric Carbon Nanotube Rings*, *Advanced Functional Materials*, Volume 18 Issue 14, (2008) Pages 2114 - 2122]
(September 22, 2008)

Unlocking the secret of the Kondo Effect
(University College, London/Nature Physics)

The Kondo effect, one of the few examples in physics where many particles collectively behave as one object (a single quantum-mechanical body), has intrigued scientists for decades. When a single magnetic atom is located inside a metal, the free electrons of the metal 'screen' the atom. That way, a cloud of many electrons around the atom becomes magnetized. Sometimes, if the metal is cooled down to very low temperatures, the atomic spin enters a so-called 'quantum superposition' state. In this state its north-pole points in two opposite directions at the same time. As a result, the entire electron cloud around the spin will also be simultaneously magnetized in two directions. Now, using a technique that was developed earlier by the same team, researchers have shown that it is possible to predict when the Kondo effect will occur – and to understand why. The key turns out to be in the geometry of a magnetic atom's immediate surroundings. By carefully studying how this geometry influences the magnetic moment (or "spin") of the atom, the emergence of the Kondo effect can now be predicted and understood.
[*The role of magnetic anisotropy in the Kondo effect*, *Nature Physics*, Published online: 21 September 2008 | doi :10.1038/nphys1072]
(September 22, 2008)

Shape changes of catalytic Rh nanoparticles during oxidation, reduction
(Science)



Credit: Nolte et al., Science

Heterogeneous catalysts often consist of metal nanoparticles absorbed on oxide supports, and the size and shape of these nanoparticles are likely to be affected by conditions in the reactor such as temperature and oxidation state. However, such changes are not readily observed experimentally because many methods require vacuum conditions. A research team was able to examine the changes to rhodium nanoparticles on a MgO surface using high-resolution in situ x-ray diffraction, as well as transmission election microscopy. At elevated temperatures (570 K), these pyramid-shaped nanoparticles became flatter upon exposure to oxygen, which causes the formation of a surface oxide. The nanoparticles returned to their original shape after exposure to CO, which causes reduction of the surface.
[*Shape Changes of Supported Rh Nanoparticles During Oxidation and Reduction Cycles*, *Science* 19 September 2008:
Vol. 321. no. 5896, pp. 1654 - 1658 DOI: 10.1126/science.1160845]
(September 19, 2008)

New architecture for single-electron devices allows CMOS-compatible fabrication
(Nano Werk)

For single-electron devices to become practical, they need to move from