Remote control nanomotor

Steerable nanorods via remote control (so to speak) have been demonstrated by Avusman Sen, Pennsylvania State Univ., University Park. The nanorods are made of stripes of different metals—one end of Au (gold), followed by a band of Ni (nickel), a band of Au, another band of Ni, and the opposite end of Pt (platinum). To make the rods steerable, the magnetized Ni bands in the rods must be smaller than their diameter so that the rods can be magnetized crosswise rather than lengthwise. When a magnetic field is switched on, the rods line up at right angles to its field lines and maintain this orientation as they move under H_2O_2 (hydrogen peroxide) power. By changing the direction of the field, the rods' direction varies, making them steerable.

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Isolated nanomechanical pendulum

A mechanism for field emission that could lead to a new type of energy efficient flat-panel display has been reported by lead investigator Robert Blick at the Univ. of Wisconsin, Madison. Here, an isolated Au (gold)-tipped island (80 × 80 × 50 nm) mechanically oscillates between two facing electrodes (does not need to be cryogenically cooled), which provide recharging and detection of the emission current. With the device, the team can trace and reproduce the transition from current flow through a rectangular tunneling barrier to the regime of field emission.

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Transistor has free space

A free-space dielectric that separates the channel of a single-crystal organic FET (field-effect transistor) from the gate electrode rather than using a traditional gate dielectric has been demonstrated by Etienne Menard and colleagues, Univ. of Illinois, Urbana-Champaign. Surface impressions are made in a metal-coated polymer substrate using imprint lithography to form raised source and drain electrodes separated by a recessed gate electrode. By placing an organic crystal between the contacts, a transistor with a gap of free space is created. This free-space dielectric avoids two problems—material defects and chemical interactions. The work is described in the December 2004 issue of *Nature Materials*.

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Network detects critical strain

Au (gold) networks created on polymer surfaces that measure mechanical strain in polymers at the sub-micron scale have been demonstrated by lead investigator Michael Myrick, Univ. of South Carolina, Columbia. In the process, a porous Al_2O_3 (alumina) membrane (200-nm dia) is sputtered with an Au coating up to 100-nm thick. A hot melt polymer is heated to 190°C and left to cool slightly before placing the Al_2O_3 stamp on its surface. Once completely cooled, the stamp is dissolved, resulting in the Au pattern transferred to the polymer and imprinted ~1-2 μm beneath the polymer surface. The Au network proved to be electrically conductive—as the mechanical strain increased above a threshold value of ~1%, the network's resistance rose. After removal of a load, the post-strain resistance is ~4-7× higher than for an unstrained specimen—the networks could detect whether a polymer has exceeded a critical strain.

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