funnels 54%, and antigraded funnels only 37%, where the fill factor provides a measure of the efficiency of the cell. That a 5% increase in fill factor was achieved on changing the structure from ungraded to graded is key to future applications, and the researchers predict the CQD funnels can improve systems with high base fill factors. Additional theoretical modeling shows that such benefits could apply to high-efficiency photovoltaics, as well as the 2–3% efficiency technologies on which these funnels were tested. The research team suggests that CQD funnel solar cells could enable higher power-per-square-foot densities, lowering the square footage of solar cells needed to power a building.

Benjamin Scheiner

Thin-film heterostructures of Fe- and Co-$BaTiO_3$ exhibit interface multiferroicity at room temperature

Materials possessing coupled room-temperature ferromagnetic (FM) and ferroelectric (FE) order are currently the subject of intense research for use in spintronic memories that store information through charge and spin. Single-phase materials displaying such multiferroic order are exceedingly rare in nature, so attention has shifted to artificially grown thin-film FM and FE heterostructures. In the October issue of *Nature Materials* (DOI: 10.1038/NMAT3098; p. 753), a group led by M. Bibes and A. Barthélémy at the CNRS/Thales laboratory in Palaiseau, France, reports on room-temperature interfacial multiferroicity in $BaTiO_3$ thin films and substrates covered by Fe and Co layers.

The research team deposited thin-film heterostructures consisting of Fe/BTO or Co/BTO onto a half metallic $La_{0.67}Sr_{0.33}MnO_3$ (LSMO) layer to form a magnetic tunnel junction. They then performed magnetoresistance and x-ray resonant magnetic scattering (XRMS) measurements to probe the magnetic structure of the Fe/BTO and the Co/BTO interfaces. The researchers found that the magnetoresistance of the junction depends on the orientation of the FE polarization in the BTO layer, which they interpret as a modulation of the spin polarization of the adjacent Fe and Co layers. The XRMS results also exhibit an asymmetry and hysteresis that corresponds to an induced interfacial magnetic moment in the BTO layer at room temperature. To better understand these observations, the researchers conducted first-principles electronic-structure calculations and determined that moments of −0.07 μB/Ti atom and

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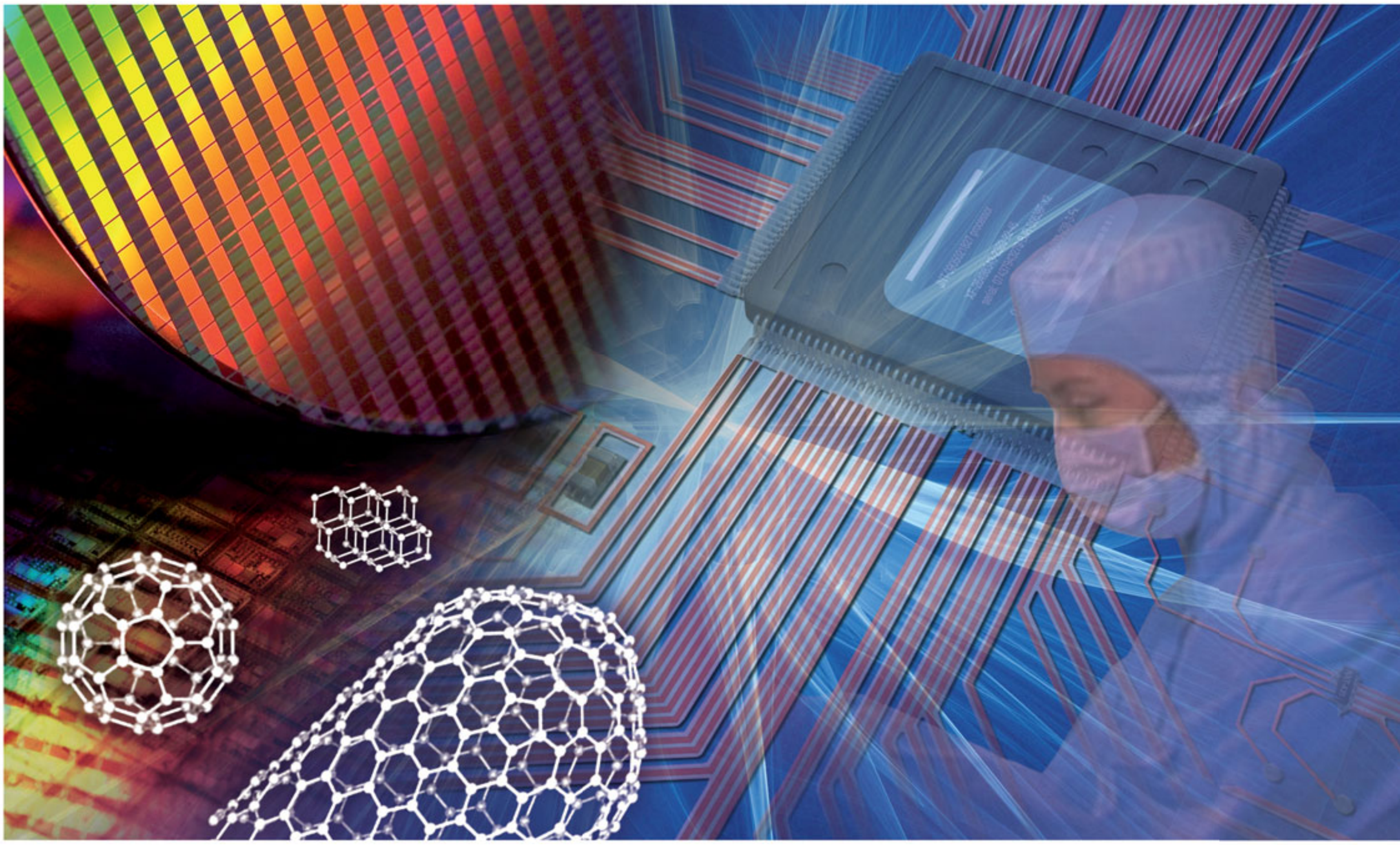

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0.05 μB/O atom should be induced in the BTO layer. These results show that the spin-polarization of the Fe/BTO and Co/BTO interfaces can be controlled by the FE polarization of the BTO layer. Magnetoelectric character can also be induced in BTO at room temperature, mediated by a spin-polarized bonding effect on interfacial Ti^{4+} ions. The researchers said that their findings may aid in the development of artificial multiferroic tunnel barriers and novel spintronic memories, as well as new kinds of coupled ferroic order.

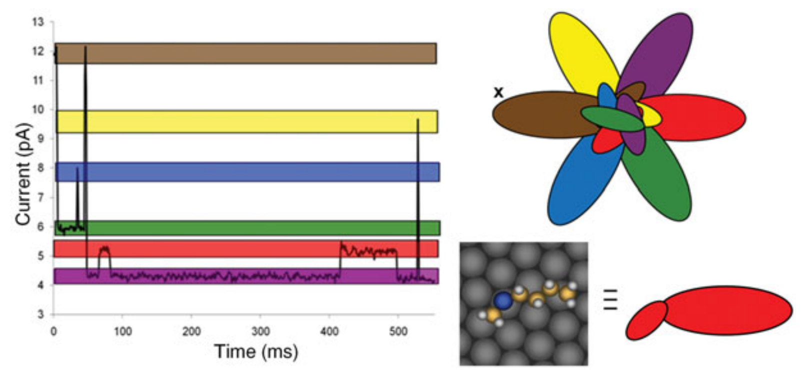
Steven Spurgeon

Nano Focus

Directional molecular motor rotation electrically driven

A research team from Tufts University has demonstrated the first known example of directional molecular rotation driven by electricity. While there are a number of examples of so-called molecular motors driven by light or a chemical reaction, this latest device described in the October issue of *Nature Nanotechnology* (DOI: 10.1038/NNANO.2011.142; p. 625) uses as impetus the electric current supplied by a scanning tunneling microscope (STM).

H. Tierney, C. Sykes, and co-workers



An example of a current versus time spectrum that provides a way of monitoring the rotation of butyl methyl sulfide between six different orientations shown in the schematic (top right). A model of the molecule on the Cu(111) surface is shown at bottom right. Reproduced with permission from *Nature Nanotech*. **6** (2011), DOI: 10.1038/NNANO.2011.142; p. 625. © 2011 Macmillan Publishers.

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