

ber of CNTs able to escape from the pores therefore depends on the pore dimensions. The researchers plan further investigation in order to quantify this geometric effect and said that "this approach should facilitate novel possibilities for the fundamental characterization and applications of microelectronic devices such as CNT-based field emitters."

STEVEN TROHALAKI

Metalloporphyrin Zeolite Analogue Demonstrates Selective Absorption of Polar Solvents

A highly crystalline solid-state material similar to that of zeolites has been synthesized using carboxylic functionalized metalloporphyrins and cobalt ions. Researchers from the University of Illinois at Urbana-Champaign led by Kenneth S. Suslick demonstrated this synthetic

method to produce such zeolite analogues in their article in the October issue of *Nature Materials*.

This material, CoT(*p*-CO₂)PPCo_{1.5}, called PIZA-1, was synthesized by heating [H₅T(*p*-CO₂H)PP] and CoCl₂•6H₂O in a sealed tube with a pyridine/KOH solvent at 150°C for 2 days. Single-crystal x-ray analysis revealed a neutral and highly crystalline network of ruffled Co(III) por-

Independent Committee Finds Scientific Misconduct in Investigation of Bell Labs Researcher Hendrik Schön

Bell Labs (Murray Hill, N.J.) announced on September 25 the findings of an independent committee it formed to investigate possible scientific misconduct, the validity of data, and scientific methodology used in a series of papers published by Hendrik Schön and co-authors. In its report, the committee concluded that Schön had engaged in scientific misconduct in 16 out of 24 allegations based on work published between 1998 and 2001. Schön's employment with Lucent Technologies/Bell Labs has been terminated. The committee cleared the other researchers who had contributed to the experiments, and who were co-authors on several published papers, of any scientific misconduct.

Bell Labs formed the committee in May after questions arose regarding the validity of data in several published papers authored by a total of 20 researchers from Bell Labs and other institutions. It named Malcolm Beasley (Stanford University) as chair; and as members: Supriyo Datta (Purdue University), Herwig Kogelnik (Lucent Technologies), Herb Kroemer (University of California—Santa Barbara), and Don Monroe (Agere Systems).

The research work in question encompassed a number of areas in condensed-matter physics and solid-state devices. These included field-induced high-temperature superconductivity in various materials, organic single-molecule transistors, organic field-effect transistors, organic junction lasers, plastic Josephson junctions, and tunable superconducting weak links.

The allegations under examination were grouped into three categories: (1) substitution of data, (2) unrealistic precision of data, and (3) results contradicting known physics. An example cited by the committee of the substitution of data includes work on self-assembled monolayer field-effect transistors (SAMFETs), published by Schön and co-authors in *Nature* **413** (2001), page 713. Very similar transistor diode

curves for two reportedly different molecules, including detailed "noise," appear in two different figures in the same paper, with the vertical scale differing by a factor of two.

An example cited by the committee of unrealistic precision of data is Schön's work on normal-state resistance of gated C₆₀, which reportedly showed a superconductive transition up to 50 K for various gate voltages. This work was published with co-authors in *Nature* **408** (2000), page 549. The systematic variation of the resistance as a function of temperature as gate voltage was varied is remarkable. The derivative of the original plotting data shows striking linearity, including the data near 50 K.

In the third category, contradictory physics, one of the allegations cited in the report involves SAMFET transistor characteristics. A well-known constraint for any device using the FET principle is that a gate-voltage change of at least ~60 mV is needed to turn off the current by a factor of 10. The SAMFET molecular devices reported by Schön and co-authors in *Nature* **413** (2001), page 713, *Science* **294** (2001), page 2140, and *Applied Physics Letters* **80** (2002), page 847, took far less gate voltage to turn off than this minimum. Furthermore, the reported devices had very poor aspect ratios, with oxide thicknesses of more than 10 times the reported channel length. Standard FETs typically have channel lengths that are 10 times the oxide thickness so that the gate, rather than the drain, controls electrostatic potential.

The committee found scientific misconduct in these examples as well as in other instances listed in the report. The committee specifically cited data fabrication in the first two examples and data falsification in the third. The devices used and the physical measurements of the significant devices in the research in question were, for the most part, fabricated by Schön alone, and he was unable to present his data

as requested by the committee. In addition, no measurement or demonstration of a significant physical effect or device characteristic was witnessed by any co-author or other colleague, with one possible exception.

The committee acknowledges Schön's dedication to research and that the allegations under review represented less than a quarter of his published work. Furthermore, the committee wrote, "As a result [of the committee's study] it is not possible to confirm or to refute the fundamental physical claims in the papers in question....In the end, the correctness of the fundamental physical claims in the work in question will come through the normal processes of science—specifically through the reproduction, or not, of the results."

In a response to the committee's report, Schön acknowledged that he had made various mistakes in his scientific work and apologized to his co-authors and the scientific community. Furthermore, Schön wrote, "I have observed experimentally the various physical effects reported in these publications, such as the quantum Hall effect, superconductivity in various materials, lasing, or gate modulation in self-assembled monolayers, and I am convinced that they are real, although I could not prove this to the investigation committee."

Jeff Jaffe, president of research at Bell Labs, said, "An experience such as this heightens everyone's awareness of the importance of ensuring scientific research integrity....We are reinforcing our policies and procedures for the publication of experimental results and encouraging more rigorous internal peer reviews. At the same time, we remain committed to maintaining the scientific freedom essential for discovery and innovation to flourish."

The committee's full report, including an executive summary, is available on the Web at http://www.lucent.com/news_events/researchreview.html.

pyrrole cores, with pyrrole rings alternately located above and below the porphyrin planes. These rings were linked by the trinuclear bridging of Co(II) carboxylate clusters. PIZA-1 has oval-shaped channels of $9 \text{ \AA} \times 7 \text{ \AA}$ along the b and c axes, with a $14 \text{ \AA} \times 7 \text{ \AA}$ channel along the a axis. Thermal analysis demonstrated a 60% mass loss associated with solvent molecules and coordinated pyridine and water molecules.

PIZA-1 demonstrated unique properties attributed to its hydrophilic cavity sites, 74% void space, and overall neutrality and robustness. In particular, PIZA-1 showed the ability to absorb high amounts of polar solvents. The researchers reported that 162 water molecules per unit cell (which has four metalloporphyrins) could be absorbed, and in a 24-h time frame, 105 ml/100 g was absorbed compared with 22 ml/100 g for traditional desiccant zeolites (e.g., Linde 4A). The researchers found similar results for amines and alcohols, which showed steric and chain-length dependence.

PIZA-1 demonstrated the ability to dry organic solvents. In this case, thiol, nitrile, aldehyde, bromide, toluene, benzene, tetrahydrofuran, and hexane may be used, as they showed little absorption. With their ability to change the metal centers and porphyrin functionalities, such structures may open new avenues in catalysis and further selective separations.

MATHEW M. MAYE

Self-Assembled, Surface-Induced Nanoscale Patterns Observed in Langmuir–Blodgett Films

Formation of surface-induced nanoscale patterns in polymer layers is the subject of recent intense experimental and theoretical studies. In the October issue of *Nano Letters*, A.L. Simões Gamboa, E.J.M. Filipe, and P. Brogueira from Instituto Superior Técnico in Portugal have reported their approach to prepare nanoscale periodic structures on the surface with potentially low surface energy, playing with the self-assembling capabilities of a diblock copolymer and a short diblock molecule, a semifluorinated n -alkane oligomer, $F(CF_2)_n(CH_2)_mH$.

The use of semifluorinated n -alkanes (SFAs) as side groups in homopolymers or block copolymers has been previously shown to generate polymers with low-surface-energy properties. On the other hand, semifluorinated n -alkanes have been reported to spread at the air–water interface and form Langmuir films. In the present approach, the semifluorinated n -alkane $F(CF_2)_8(CH_2)_{18}H$ was “blended” with an amphiphilic block copolymer, and the blend was confined at the air–water interface by the Langmuir technique. To do so, mixed solutions, corresponding to various proportions of SFAs and a polystyrene-poly(ethylene oxide) (PS-PEO) diblock copolymer in chloroform, were spread at the surface of deionized water in a Langmuir trough; the spread films were then compressed. The PS-PEO copolymer used had a PS block of 40 monomers and a PEO block of 123 monomers. The hydrophobic PS blocks graft the copolymer to the air–water interface; the PEO blocks are adsorbed at the interface at a low number of grafts per unit area and stretched into the water subphase as the film is compressed, eventually resulting in a “brush” configuration. The films were transferred onto hydrophilic glass substrates by the Langmuir–Blodgett technique at desired polymer grafting densities.

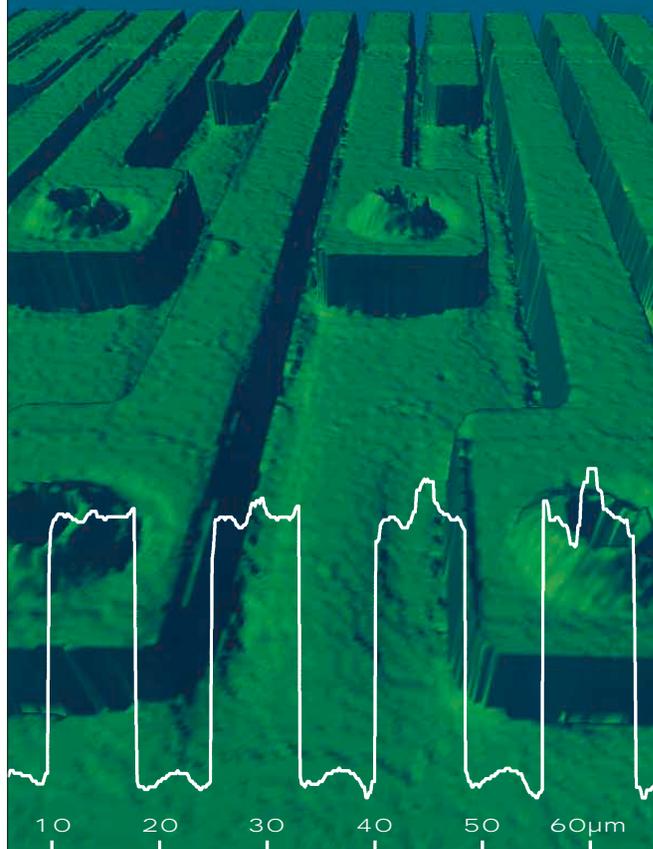
From the surface pressure versus area curves for the prepared Langmuir films, the researchers observed that the presence of SFAs has a significant effect on the films: The maximum surface pressure obtained by compressing the film increases with increasing PS-PEO grafting density. But all of the films' surface pressure versus area curves have a shape that resembles the curve of pure SFAs and will reach about the same limiting area value as the pure SFA film. Consequently, the surface will be

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