possible (for a given tube length) through rational interface design for optimized heat dissipation and phonon relaxation." The discovery, they said, "may have general implications for high-current applications of quasi-1D materials." The researchers also said that their discovery may lead to new device applications consisting of suspended SWNTs.

STEVEN TROHALAKI

Reversible Guest Exchange Demonstrates Robustness of Zinc-Porphyrin–Based 3D Coordination Networks

Porous crystalline solids with a controlled pore size are attractive candidates for use in gas storage and separation, specific sorption, ion exchange, and catalysis. Three-dimensional porous crystalline materials are often assembled from precursors known as tectons—molecules whose interactions are predominantly dominated by forces that induce their self-assembly into organized architectures. In the August 8 issue of *Chemical Communications* (p. 3906; DOI 10.1039/b508135c), E. Deiters, V. Bulach, and M.W. Hosseini from Louis Pasteur University in Strasbourg have reported the synthesis of a novel zinc porphyrin tecton, which assembles into a robust crystalline network.

The tecton consists of a metalloporphyrin core with two meso positions of the porphyrin core functionalized with pyridine groups. The zinc core and the two oppositely oriented pyridines are available for further coordination; thus, this self-complementary molecule can assemble into an infinite three-dimensional coordination network. The coordination geometry around the Zn center leads to the formation of hexagonal channels in the network.

The researchers found that the voids in the hexagonal networks were filled with solvent molecules. These solvent molecules could be easily removed from the channels under a vacuum. Furthermore, the solvent molecules (methanol or ethanol) were reintroduced into the channels upon exposure to solvent vapor, or could even be replaced by other molecules such as cyclohexane, while still preserving the hexagonal channel structure. Thus, guest exchange between different solvents in the channels of the network occurs by a single-crystal-to-single-crystal transformation, retaining the structural integrity of the framework at all times. The researchers said that many crystalline porous solids collapse upon removal of included guests; thus they found remarkable the robustness of the three-dimensional framework achieved with this tecton.

SARBAJIT BANERJEE

Rare "Triple Coincidence" of Optical Nonlinearities for Use in Quantum Encryption and Teleportation Engineered in Periodically Poled KTP

One of the strangest aspects of quantum mechanics is the phenomenon of entanglement. Entangled particles share identical or complementary properties, such as energy, spin, or momentum, even when the values of those properties are undefined for the individual particles. Entanglement can also exist between different electromagnetic-field modes of bright (many-photon) laser beams. This area, known as continuous variable (CV) entanglement, has become a major focus of interest for quantum encryption and

quantum teleportation applications. As reported in the October 1 issue of *Optics Letters* (p. 2635), Raphael C. Pooser and Olivier Pfister of the University of Virginia have demonstrated that a modified $KTiOPO_4$ (KTP) crystal can be used to mediate multiple nonlinear optical processes simultaneously, potentially allowing it to act as the heart of a many-mode CV entanglement source.

The generation of two CV-entangled modes (bipartite entanglement) is accomplished by first creating two "squeezed" beams in an optical parametric oscillator (OPO) operating just below threshold. These beams, which display reduced fluctuations in one particular phase combination of the electric and magnetic field, are next overlapped on a 50/50 beam splitter. The two output beams of the beam splitter are CV-entangled and can be used for quantum encryption or quantum teleportation. To increase the number of parties participating in the encryption or teleportation scheme, researchers at the University of Tokyo recently built a tripartite (three-mode) CV entanglement source using three separate OPOs whose outputs were made to stably overlap on multiple 50/50 beam splitters. Earlier work by Pooser, Pfister, and their colleagues showed that tripartite CV entanglement could be achieved using only a single OPO, if the nonlinear crystal at the heart of the OPO could be engineered to constructively enhance, or phase-match, two different nonlinear optical interactions simultaneously.

For the study reported in *Optics Letters*, Pooser and Pfister used a 7 mm crystal of periodically poled KTP with a carefully chosen 45.65 μm period. As predicted by theory, when pumped with light at 1.49 μm, the crystal displayed simultaneous phase-matching for three independent nonlinear processes (two second-harmonic generation processes and one sum-frequency generation process), sufficient in principle for as much as quadripartite (four-mode) CV entanglement. This rare "triple coincidence" suggests that complex multipartite CV entanglement sources based on only a single OPO are feasible with the appropriate crystal engineering. Such sources could ultimately become critical components in applied quantum encryption and quantum teleportation systems.

COLIN MCCORMICK

SAMs Serve as Templates for Patterned Growth of Large Oriented Organic Semiconductor Single Crystals

Organic electronic devices fabricated from high-quality single crystals of organic semiconductors have increased mobility due to the lack of grain boundaries and molecular disorder. One of the challenges that limits application of single-crystalline organic semiconductors is the fragility of the crystals, which creates problems in handling them. If the oriented single-crystalline organic semiconductor could be selectively grown directly in the designated locations in a device structure, this problem could be solved. Recently, a group of researchers in the University of California at Los Angeles, Lucent Technology, and Stanford University have made progress toward this goal. As reported in the September issue of the *Journal of the American Chemistry Society* (p. 12164; DOI: 10.1021/ja052919u), A.L. Briseno of UCLA, J. Aizenberg of Lucent, Z. Bao of Stanford, and their colleagues have demonstrated a method for inducing site-specific growth of large oriented organic semiconductor crystals using micropatterned self-assembled monolayers (SAMs) bearing regions of oligophenylene thiols as nucleation templates.

The researchers first tested the ability of different SAM-modified gold substrates to serve as templates for the formation of organic semiconductor crystals using a solvent evaporation method. They immersed substrates modified with SAMs of alkanethiols bearing methyl ($-CH_3$), terphenylthiol (–3P), and other oligophenylene thiols in a saturated anthracene/THF solution and allowed them to evaporate over several days. They