spectroscopy was used to monitor the reduction kinetics. Transmission electron microscopy (TEM) and scanning force microscopy were used to analyze the products. Regular, continuous chains of nanoparticles, of 4-nm average diameter, form over the contour length of DNA in contrast to the large cluster agglomerates, of ~50-nm average diameter, that form in the absence of DNA. High-resolution TEM images of the nanoparticles show lattice-plane distances identical to bulk platinum.

The researchers showed that the metallization rate and the balance between heterogeneous and homogeneous nucleation can be controlled by varying t_a. An accelerated process and altered nucleation behavior results from increasing t_a. Vanishingly small activation times result in mostly homogeneously nucleated large clusters and a small number of small clusters on the DNA strands. Exclusively heterogeneous nucleation takes place after long activation times (~20 h). The researchers expect that heterogeneous cluster nucleation may be influenced by the DNA composition because it has been previously shown that the complexation kinetics is nucleotide-specific to a certain degree.

Mertig suggests that "strong donor ligands other than DNA, bound to metal ions before (or during) the reduction process to form organometallic complexes, may induce cluster nucleation in a similar way." Mertig expects formation of similarly nucleated platinum nanoparticles on proteins if heterocyclic amino acids are present.

STEVEN TROHALAKI

Thin Oxide Films Crystallized with Low-Temperature Anneals

Sangmoon Park and colleagues from Oregon State University, along with collaborators from ReyTech Corp. and Hewlett-Packard, reported their work on low-temperature thin-film deposition and crystallization in the July 5 issue of *Science*. Park and colleagues described their deposition and annealing techniques, which allowed for the creation of thin-film crystalline oxides for applications in displays, electronics, and energy storage. Typically, a high-temperature processing step is required to crystallize deposited amorphous films. This creates constraints to obtain desirable characteristics of the film while maintaining stability of the substrate, in addition to increasing the cost. By using a unique method of preparing the oxide powders by precipitation and hydrothermal dehydration, and depositing them using the successive ionic layer adsorption and reaction (SILAR) deposition method, the researchers have created amorphous films that crystallize under low-temperature hydrothermal annealing.

The oxide powders were created by dehydrating a hydroxo precipitate under hydrothermal conditions to form an anhydrous crystalline oxide. The SILAR process consists of repeated monolayer coatings of material and water rinsing until the desired film thickness is achieved. The samples underwent 700 cycles of ~0.1 M solutions and rinse baths for 10 s each by robotic control to obtain layer thicknesses of ~250 nm. The samples were then dehydrated for ~12 h. Films of several oxides, (Zn_2SiO_4, ZrO_2) and (MnO_2, Mn_2O_3), were deposited on Si_3N_4/Si and SiO_2/Si substrates, respectively, using the SILAR process, creating amorphous films. Low temperature (378–473 K) hydrothermal annealing in a sealed 23-ml Teflon-lined Parr reactor with 0.15 ml of water produced highly crystalline films, as determined by x-ray powder diffraction. Annealing the as-deposited films at higher temperatures (773–923 K) did not produce crystalline material in the case of Zn_2SiO_4, and pro-

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duced alternate crystal forms for the remaining materials.

CHRISTINE RUSSELL

Glass-Ceramic Materials to Provide Broad-Band Light Sources

Active light-emitting fibers have multiple applications in photonics, particularly as lasers and amplifiers. The most widely used active fibers are formed from silica-based glasses doped with rare-earth ions. B.N. Samson and co-workers from Corning, Inc. have turned their attention to glass-ceramic fibers. Glass ceramics can be formed by suitable heat treatment of a glass, thus producing the growth of a crystal phase embedded in a glassy matrix. The crystalline phase in these fibers allows not only the use of rare-earth ions for light emission, but also the use of transition-metal ions due to their broad emission bands. In addition, the inherent broad absorption band of the metal transition ions expands the choice of pump wavelengths.

In the August issue of *Optics Letters*, the research team reported the performance of a fiber formed by gallate-rich aluminosilicate spinel nanocrystals (~10 nm in size) dispersed uniformly throughout a continuous silicate glass matrix and doped with nickel. The researchers studied the fluorescence spectra, including fluorescence lifetimes, and output power as a function of nickel doping density, heat treatment (crystallization), and optical pump power. The fluorescence spectrum pumped at 980 nm showed a broad-band emission that, for the optimized spectrum, has ~250 nm bandwidth (full width at half maximum [FWHM]) peaking at a wavelength near 1200 nm. The original glass matrix showed no measurable light emission. The shape and intensity of the band depends on the heat treatment. This result shows the clear advantage of using a nanocrystalline environment for the transition-metal ions, according to the researchers. The researchers also report the output of a codoped nickel and thulium ceramic glass fiber pumped by a single ytterbium fiber (1060 nm). This source provides a light source with 450 nm bandwidth (FWHM).

The researchers suggested that these broad-band sources could replace those formed by multiple edge-emitting sources. The research team is currently investigating many novel glass-ceramic systems containing doped crystals that cannot be made in single-crystal form, and the team believes that this research route will significantly expand the range of crystal hosts that can be investigated for potential applications.

ROSALÍA SERNA

Photo-Orientation of Mesostructured Silica Films at Large-Scale Levels Demonstrated

The preparation of mesostructured films with high orientation order at the macrolevel is emerging as a new area of technological and scientific interest. In particular, it is a key technology for developing novel sensors, micro- and optoelectronics, and separation devices, for example. A group of researchers from the Tokyo Institute of Technology and the Science University of Tokyo has discovered a method for the synthesis of macroscopically aligned mesostructured silica films using a hierarchical multiple transfer technique and photoinduced orientation. As reported in the July issue of *Chemistry of Materials*, Yasuhiro Kawashima and co-workers first performed the deposition of a photochromic layer (Az; photochromic unit: C_6H_{13}-C_6H_4N=NC_6H_4-O-$(CH_2)_{10}$-COO on polyvinyl alcohol) by the Langmuir–Blodgett method, followed by irradiation with linearly polarized light, which resulted in the re-orientation of the azobenzene chromophores to the orthogonal, that is, nonexcitable, direction with respect to the substrate. A spin-cast film of poly(di-*n*-hexylsilane) (PDHS) with a thickness of 60 nm was deposited onto the previous molecular layer. After sufficient crystallization of the PDHS spin-cast film, this film became highly optically anisotropic with a Si backbone aligned perpendicular to the photoaligned chromophore layer. In the last step, a mesostructured silica layer was formed on the photoaligned PDHS by polycondensation of tetraethoxysilane in the presence of an organic template. The researchers said that attempts to directly deposit the surfactant-templated silica onto the Az monolayer were unsuccessful because the conditions adopted for the siloxane condensation crucially damaged the orientation of the Az layer. The researchers removed organic surfactant molecules from the composite by using a recently developed "photocalcination" method achievable at room temperature.

With low-angle x-ray diffraction, the researchers confirmed a well-defined ordered structure and perfect in-plane orientation of mesochannels. The research team showed that the preferential orientation of photo-oriented mesochannels was parallel to the direction of light polarization. The researchers also proposed a way to obtain patterned films of mesoporous silica by the conventional photolithography technique. These experimental results provide the possibility of fabricating mesostructures on the microlevel.

ANDREI A. ELISEEV

News of MRS Members/Materials Researchers

Erich Bloch, a principal of The Washington Advisory Group, LLC, a distinguished fellow at the Council on Competitiveness, a former National Science Foundation (NSF) director, and an outspoken supporter of fundamental research in leading innovation, has received the **2002 Vannevar Bush Award** given by the National Science Board on May 7 in Washington, D.C., in tribute to his long-standing reputation in research and innovation, and his senior statesman status in science and engineering.

Rod Ewing of the Nuclear Engineering and Radiological Sciences and Materials Science and Engineering Departments at the University of Michigan has been named a **Guggenheim Fellow**. Guggenheim Fellows are appointed on the basis of distinguished achievement in the past and exceptional promise for future accomplishment. The 2002 Fellows include writers, painters, sculptors, photographers, filmmakers, choreographers, physical and biological scientists, social scientists, and scholars in the humanities. Ewing's Fellowship will support his work on a book that analyzes the impact of the nuclear fuel cycle on the environment.

Mihal Gross has been selected as a RAND/AAAS Science and Technology Policy Fellow for 2002–2003. She begins her term in Washington, D.C., in September. Gross expects her focus to be on policy issues related to nanotechnology, industrial competitiveness, and national

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