

solution. Water shifts the conversion toward  $\alpha$ - $\text{Al}_2\text{O}_3$ , which is a transition structure.

As reported in the September issue of the *Journal of the American Ceramic Society*, the investigators mixed high-purity aluminum isopropoxide with diethylene glycol monoethyl ether and acetic acid, and then produced the gel, which was deposited on silicon wafers. They compared two coating procedures: standard dip-coating and dip-coating combined with a fast thermal treatment.

A series of x-ray diffraction (XRD) patterns showed the development of the crystallization process in which the first crystalline phase to appear is  $\gamma$ - $\text{Al}_2\text{O}_3$  after annealing for 30 h at 700°C. Simultaneous formation of  $\alpha$ - $\text{Al}_2\text{O}_3$  started after annealing for 30 h at 800°C. The amount of  $\alpha$ - $\text{Al}_2\text{O}_3$  increased with temperature until it was 100%  $\alpha$ - $\text{Al}_2\text{O}_3$  after annealing for 30 h at 950°C. Regarding the amount of time needed for complete conversion, the XRD pattern series showed that at 950°C, it was 10 h, at 1000°C it was 2 h, and at 1100°C it was only 1 h. These are very short times compared with standard procedures.

Concerning the differences in the applied coatings, crystallization occurs only in the coatings exposed to the rapid thermal treatment, as revealed by x-ray analysis. Bahlawane and Watanabe suggest that diffusion of Si on the film during the slow drying, observed after energy dispersive x-ray analysis of these films, prevents recrystallization of  $\alpha$ - $\text{Al}_2\text{O}_3$ , therefore leaving the amorphous film of  $\text{Al}_2\text{O}_3$  and Si.

SIARI S. SOSA

### Two-Dimensional Macroporous-Silicon Photonic-Crystal Waveguides with Large Mid-Infrared Transmission Bandwidth Fabricated

Researchers from the University of Toronto, the Max-Planck-Institute of Microstructure Physics, and the Massachusetts Institute of Technology have fabricated and demonstrated the operation of a new type of optical waveguide made in a photonic crystal. As they report in the October 15 issue of *Optics Letters*, their silicon waveguide efficiently guides and confines infrared light using a photonic bandgap.

A two-dimensional silicon photonic

crystal was fabricated in macroporous silicon by lithography and wet etching techniques. A triangular lattice of 100- $\mu\text{m}$ -long cylindrical pores, with a spacing of 1.5  $\mu\text{m}$ , was formed in a silicon wafer. The resulting two-dimensional photonic crystal had a photonic bandgap (a spectral region over which the propagation of light is inhibited) spanning 3.1–5.5  $\mu\text{m}$  in wavelength for light polarized along the axis of the pores. By leaving out a row of pores, a one-dimensional defect was created in the lattice, forming a narrow 1  $\mu\text{m}$  waveguide cladded by the two-dimensional photonic crystal. Light from a parametric source was focused onto the entrance of the waveguide, and the transmission spectrum was measured over the bandwidth of the bulk crystal photonic bandgap.

The measured spectrum showed a very large transmission bandwidth nearly equal to that of the bulk crystal bandgap, in agreement with calculations. Furthermore, based on the agreement between theory and experiment, single-mode operation of the waveguide is predicted with a bandwidth of 10%. This bandwidth is significantly larger than that of current fiber-optic systems. These results demonstrate the use of photonic crystals to confine and guide light on the micrometer scale. Unlike traditional waveguides, which employ total internal reflection for light confinement, the photonic bandgap confinement mechanism allows for tight waveguide corners and a high density of optical integration. According to the researchers, photonic-crystal waveguides therefore represent an exciting technology for next-generation optical circuits.

JUNE LAU

### Bohrium 267 Compound Found to be Volatile at 180°C

An international collaboration of radiochemists has determined the volatility of bohrium, element 107. According to their article published in the September 7 issue of *Nature*, the team, led by Heinz Gaggeler of the University of Bern and the Paul Scherrer Institute (PSI) in Villigen, Switzerland, created bohrium 267 at PSI's PHILIPS cyclotron. They used a beam of neon 22 to bombard a target of berkelium 249, which has a half-life of 320 days.

Immediately after bombardment, the reaction products were swept into an automated system where they formed molecules in oxygen-containing hydrogen chloride gas. These oxychlorides were then passed through a chromatography column, in which the more volatile species pass through at lower temperatures.

During the month-long experiment, about three atoms of bohrium were creat-

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