For the XRD measurements, 400-nm-thick Al was deposited onto 500-nm thick PECVD α-Si:H. The area of the Si ⟨111⟩ peak was measured at different temperatures. At 140°C, there was no indication of crystallization. After 2–3 min at 150°C, the area of the peak began to increase. More than 40% of the film crystallized within 15 min. The Al was removed by etching and the XRD measurements were repeated, with temperatures up to 250°C. No increase in the ⟨111⟩ peak area was observed, implying that no crystallization occurred after the Al film was removed, even when annealed at 250°C for 20 min.

Since Al diffusion in α-Si:H at 150°C has been previously reported by several scientists, these researchers believe that the activation energy for crystallization was reduced by Al atoms in the α-Si:H. This agrees with previous work by other researchers showing that implanting P, B, or As in α-Si:H enhances the solid-phase crystallization.

ELIZABETH SHACK

High-Quality, Manganese-Doped ZnSe Nanocrystals Prepared by High-Temperature Organometallic Synthesis

A team of researchers has unveiled a method of preparing manganese-doped ZnSe nanocrystals that are not only superior to previously doped II–IV materials, but are also comparable in quality with the best-known undoped nanocrystals. In their work, published in the January issue of *Nano Letters*, D.J. Norris (NEC Research Institute), N. Yao (Princeton University), and F.T. Charnock and T.A. Kennedy of the U.S. Naval Research Laboratory have used an adapted version of the high-temperature, organometallic synthesis method developed by Hines and Guyot-Sionnest in 1998. Instead of the previously used organometallic source for Mn (diethylmanganese), the researchers used dimethylmanganese, whose lifetime is significantly longer.

To verify that Mn was actually embedded inside the ZnSe nanoparticles, instead of segregating to their surfaces as in the case of CdSe, the researchers applied optical, magnetic circular dichroism (MCD) and electron paramagnetic resonance (EPR) measurements. While photoluminescence and photoluminescence-excitation spectra showed successful doping, they could not guarantee that Mn was actually substituting for Zn in the nanocrystals. The confirmation for that came from the EPR results, which have shown values similar to those for Mn located at cubic lattice sites in bulk ZnSe. In addition to providing evidence for successful doping, the MCD data also provided clues about the doping level in the samples prepared, with values within the limit of one manganese atom per crystallite or less, implying an atomic Mn:Zn ratio of 0.025–0.125%.

This simple method for preparing and testing high-quality ZnSe nanocrystals could provide a model for gaining a detailed understanding of dilute magnetic semiconductor nanocrystals and their potential applications such as trapped single-spin manipulation for the developing field of spintronics.

CLAUDIU MUNTELE

Reversible Thermal Denaturation of Immobilized Met-Hemoglobin Demonstrated

Enzymes, which have been extremely desirable catalysts for chemical reactions, are confined to use at room temperature because of their thermal instability. Immobilized met-hemoglobin (Fe(III) Hb), which showed peroxidase activity in the presence of hydrogen peroxide, is one such example. It starts to denature at 73°C with the loss of peroxidase activity and α-helical content. In the February issue of *Chemistry of Materials*, professor C.V. Kumar and coworker A. Chaudhari from the University of Connecticut report that Hb, immobilized at the galleries of α-zirconium carboxymethyl phosphonate (α-ZrCMP), did recover after heat denaturation.

The researchers used x-ray diffraction and spectral measurements of circular dichroism and Fourier transform infrared (FTIR) absorbance to verify the reversible thermal denaturation of immobilized Hb/α-ZrCMP. The increased d spacings of the immobilized Hb on a series of galleries shrank upon heating; however, the d spacings of Hb/α-ZrCMP recovered after cooling for an hour while the others did not, even after cooling for an extended period. Also, the native protein had characteristic bands in its circular dichroism spectra and IR absorption spectra. The characteristic bands of renatured Hb/α-ZrCMP remained in position or nearly completely recovered after cooling. However, those characteristic bands either shifted or only partially recovered for other immobilized Hb after denaturation and cooling. The peroxidase activity of immobilized Hb/α-ZrCMP after denaturation gradually recovered and reached

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