hydrothermal process exhibit longer lifetime than those prepared by the normal hydrothermal process. The researchers concluded that the reductive hydrothermal process is desirable for the synthesis of other efficient Ce^{3+}- or Tb^{3+}-doped nanophosphors.

ZHAOYONG SUN

A New Synthesis Route Yields Mg- and Zn-Doped GaN Powders with Blue-Violet Cathodoluminescence

Gallium nitride thin films on different substrates have been extensively produced and studied due to the direct wide bandgap semiconductor properties of GaN. H.-L. Li and collaborators of the National Institute for Materials Science in Tsukuba, Japan, obtained GaN powders, pure or doped with well controlled amounts of Mg or Zn by employing a high yield fabrication method involving the direct transformation of metal oxides into their nitrides under a flow of ammonia.

As the researchers reported in the May issue of the *Journal of the American Ceramic Society* (DOI: 10.1111/j.1551-2916.2008.02338.x; p. 1711), powders of GaN containing up to 2 at% Mg or Zn have been synthesized in a horizontal tube furnace heated under a flow of ammonia at 800–1000°C, and then cooled down to room temperature while keeping the ammonia flow constant. Subsequent x-ray powder diffraction, induction coupled plasma, and oxygen-nitrogen analyzer measurements revealed an almost perfect nitridization of the precursor Ga_2O_3 powder, coupled with a well controlled incorporation of Mg and Zn by stoichiometric addition of their corresponding oxides in the initial mix, while scanning electron microscopy imaging of the resulting powders showed a structure of compact agglomerations of 100–200 nm crystallites.

Cathodoluminiscence (CL) measurements revealed that the doped powders exhibit a bright blue-violet emission (at 3.05 eV for Mg, and 2.81 eV for Zn as the dopant), and offered evidence that the metals are incorporated as acceptors, a desired condition for optoelectronic applications. The CL intensity of the emission reached a peak for 1.0 at% of doping metals for both Mg and Zn. Longer time CL measurements demonstrated that the stability of the intensity increased with increasing Mg concentration, with a saturation also for 1.0 at%, where a loss of intensity of 36% was recorded after one hour, with respect to 60% loss for undoped samples. Further studies on the dependence of the CL intensity on the accelerating voltage and beam intensity showed a continuous increase with no brightness saturation in the range of 1.5–19 kV, and 400–2500 pA, respectively, which makes this type of material a good candidate for electroluminescent devices applications, said the researchers.

EUGEN PANAITESCU

Surface Plasmon Resonance and AFM Targeting Selectively Melts and Evaporates Gold Nanoparticles

E.A. Hawes and collaborators at the University of Kentucky have demonstrated an approach to selectively melt and evaporate gold nanoparticles that may soon be a low-energy approach to nanoscale patterning of different particles on substrates, as reported in the June 15 issue of *Optics Letters* (DOI: 10.1364/OL.33.001383; p. 1383).

Gold nanostructures (50 nm and 100 nm in diameter) exhibit enhanced optical absorption at wavelengths associated with surface-plasmon resonance (SPR), where sharp, silicon atomic force microscopy (AFM)-probes enhance the electromagnetic fields near their tips. Earlier research referenced in the article showed that particle shape, size, and surrounding media play an important role in determining the energy absorption.

Spherical, gold nanoparticles were dispersed on a glass microscope slide and placed in contact with an equilateral BK7 glass prism using index matching fluid. Then 532-nm light from a 15 mW laser was reflected (on the side opposite of the sample) at an angle of incidence over 70° to achieve total internal reflection. The scan speed of the AFM probe (silicon tip, 10-nm radius, half-cone angle of 20–25°) determined the interaction time between the SPR energy field and the gold nanoparticles. The data shows that melting/evaporation only occurs in conjunction with the SPR-wavelength radiation and the close proximity of the AFM tip to the nanoparticles.

Two important demarcation points appear from the data: (i) a minimum interaction time with the probe, and (ii) a corresponding calculated minimum energy needed to melt/evaporate the particles. In addition to scan speed, the threshold interaction time is a function of particle size and distance between the probe tip and particle sample. It should be noted that multiple passes by the probe did not appear to have a cumulative effect as the radiative cooling of the nanoparticles happens in a relatively short time compared to the lapsed time between passes by the probe. The researchers said that near-field radiation transfer and detailed emission/absorption mechanisms continue to be explored.

THAD AWEEKA

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