Fabrication of Luminescent Nanoflowers

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Visually striking nanoflowers composed of ZnS:Mn^{2+} nanoparticles are prepared and characterized. The configurations of these fractal structures are very sensitive to both the pH values of the particle solutions from which they are precipitated and the substrates on which they are deposited. At pH 2.2, the fractal structures resemble trees without leaves; at pH 7.7, they are tree-like with four arms and at pH 11.0 they resemble trees with 6 arms. High resolution transmission microscopy reveals that the nanoflowers are composed of ZnS:Mn^{2+} nanoparticles of 2 – 5 nm in size. X-ray photoelectron spectral data indicate that the sample compositions of nitrogen, chlorine, and sulfur vary gradually with pH values of the solutions. These changes may have an impact on both the fractal configuration and the luminescence properties. The emission spectra of the particle solutions at pH values of 2.2 and 11.0 are similar with the emission maximum at 475 nm. As the pH value approaches 7.7, the emission spectral maximum shifts to longer wavelengths. At a pH value of 7.7, the emission peak wavelength is the reddest, 520 nm. The emission peak of the nanoflowers at a pH value of 9.3 is 510 nm, while the emission spectrum of the nanoflowers at 5.2 has two peaks at 500 nm and 440 nm, respectively. These blue-green emissions are attributed to defects and are the dominant luminescence from the nanoflowers. The emission from Mn^{2+} dopant is only observed in the delayed spectra of the fractal solid samples. The authors would like to thank DOE for funding.

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