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Synthesis of protein encapsulated rear earth nanoparticles

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Abstract

To get homogeneous nanoparticles (NPs), protein (apoferritin) cavity has been utilized as a reaction chamber. Protein shells served as a template to restrain particle growth and as a coating to prevent coagulation between NPs. Apoferritin is an iron storage protein found in many biological species, known to mineralize several metal ions in vitro. It is a hollow, spherical protein composed of 24 subunits, with outer and inner diameters of 13 nm and 7.4 nm, respectively. Here I report synthesis of rare earth NPs (yttrium (Y), europium (Eu) and terbium (Tb) NPs, and Eu or Tb doped Y NPs) in the cavity of apoferritin. The diameter of each NP is around 7 nm and discrepancy of the size is within 1 nm. Eu and Eu doped Y (Y:Eu) nanoparticles exhibit red photoluminescence (emission peaks: 590 and 614 nm), while Tb and Tb doped Y (Y:Tb) nanoparticles exhibit green photoluminescence (emission peaks: 488, 544, 582 and 618 nm). High-resolution electron microscopy observations reveal that about 5% of the nanoparticles have a lattice structure, while the remaining nanoparticles are amorphous. Electron diffraction of the Y nanoparticles gives lattice spacing's corresponding to the cubic structure of yttrium oxide (Y_2O_3). Photoluminescence intensity increases by increasing dopant concentration up to 60% of the host in Y:Eu and 40% in Y:Tb. Because nano-meter scale particles are homogeneously dispersed in the solution, concentration quenching typically observed in bulk sample would be suppressed.

Biography

Yoshimura has completed his Ph.D in 1982 from Nagoya University and postdoctoral studies in Institute of Physical and Chemical Research (RIKEN). He moved to Biometrology Lab in JEOL Ltd., as a Research staff in 1984. He was also joining JRDC, ERATO NAGAYAMA Protein Array Project from 1990 to 1995, as a manager of Array Characterization Group. After 1995, he moved to Meiji University, Department of Physics, as an associate Professor. He promoted to Professor in 2000 at the same department. His current interests are development of an X-ray microscope for biology and synthesis of nanoparticles utilizing protein function.