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Biopolymer-assisted self-assembly of ZnO nanoarchitectures from nanorods

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Abstract

We have investigated three-dimensional (3-D) architectures – microspheres and radial structures – based on biopolymer-assisted self-assembly from one-dimensional ZnO nanorods. The developed method is simple, rapid and cost-effective and can be used for self-assembly of different complex superstructures. A possible model of 3-D architectures self-assembled with biopolymer assistance is presented using minimum energy considerations. Scanning electron microscopy, X-ray diffraction, energy dispersive X-ray spectroscopy, transmission electron microscopy, micro–Raman spectroscopy and cathode luminescence investigations show that the novel 3-D architectures are built from high-purity ZnO nanorods with a wurtzite structure. The resulting radial structures show an intense ultraviolet (UV) cathode luminescence emission suggesting applications as UV light emitting diodes or lasers. Their structural characteristics endow them with a broad area of applications and offer a possibility to be used as fundamental low-dimensional building units. These building units open opportunities for the self-assembly of multifunctional nanostructured systems with applications in bioscience and nanomedicine, electronics and photonics.

Keywords: ZnO nanorod; Self-assembly; Nanofabrication; Cathodeluminescence

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