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Functionalization of photonic bandgap materials

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Photonic bandgap materials (PBMs) offer unique properties and promising prospects for intriguing applications such as localization of light within small mode volume of a few cubic wavelengths, suppression of spontaneous emission, and modification of blackbody radiation. Recently, intensive experimental and theoretical research has been conducted on metallic PBMs and hybrid PBMs because of their ability to control light through both photonic bandgap and plasmonic interactions. The hybrid platform provides a versatile environment for the control over the spontaneous emission once proper luminescent emitters are introduced.

In this paper, by using the two-photon polymerization technique, high quality PBMs have been fabricated. Transmission measurement shows a partial gap of 80% at an approximately 1100 nm wavelength. Silver layers with thicknesses of 40-50 nm and good smoothness were formed on the polymer PBMs with a modified electroless coating method. The PBMs possess not only strong PBGs but also significant localized plasmon resonances (LPRs) in the near-infrared region due to the existence of the silver nanoshells coated on the polymer rods. PbSe-CdSe core-shell quantum dots (QDs) have been synthesized through the wet chemical procedures and linked on the surface of the silver layer, providing the final component for the activation of the PBMs. Lifetime variations of QDs are measured in the PBMs.

Biography

Baohua Jia received her Ph.D. in optics in 2007 in Australia. Now she works as an Associate Professor and research leader at the Centre for Micro-Photonics at Swinburne University of Technology. Jia has co-authored more than 160 publications in highly ranked journals and prestigious international conferences including Nature Photonics, Advanced Materials and Nano Letters. She has received numerous prizes and awards including the L'Oréal Australia and New Zealand for Women in Science Fellowship in 2012, Discovery Early Career Researcher Award from the Australian Research Council in 2012, Vice-Chancellor's Awards in 2011 and 2009, and Victoria Fellowship from the Victorian Government in 2010.

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