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Is there a required lattice match in horizontal growth of nanowires?

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Metal-catalyzed surface-directed vapor-liquid-solid (SVLS) growth of nanostructures has been shown to be a promising platform for horizontal formation of nanowires (NWs) and their scalable interfacing. One of the benefits of this method is elimination of post-growth assembly processes and offering a direct route for in-situ device integration. We have been exploring thisapproach for growth of a variety of semiconductor heterojunctions and in this talk we present some of our latest data on growth and characterization of $TiO_2$and CdSe on GaN and Sapphire. While lattices of the selected crystals theoreticallydo not show any matches, directed and horizontal growth indicates existence of a pseudo-lattice match in a preferred growth direction. Results show that this preferred direction is required to be along the width of a NW. However, in better lattice-matched heteroepitaxies, this match could be overshadowed by the lattice match along the NW length. We also present examples on influence of the substrate on defining thenanocrystal orientation and contrast them with other classes of crystals such as wurtzite or cubic that tends to growin specific crystal orientations regardless of the structure of the substrate.

Biography

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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 PhD in Optics in 2007 in Australia. Now she works as a Research Leader at Swinburne University of Technology. Her research is focused on ultrafast laser imaging, spectroscopy and nanofabrication of novel photonic nanomaterials and nanostructures. Jia has co-authored more than 160 publications in highly ranked journals and prestigious international conferences. She has received numerous prizes and awards including the 2013 Young Tall Poppy Science Award, L'Oréal Australia and New Zealand for Women in Science Fellowship in 2012, Discovery Early Career Researcher Award (DECRA) from the Australian Research Council in 2012.

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