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Quantum nanoparticles doped polymer waveguides for light propagation

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High-refractive-index polymer hybrid materials, such as OrmoClear show interesting properties for a variety of potential applications. When doped with quantum nanoparticles, this hybrid polymer promotes enhanced optical properties that can have huge advantage in photonic applications. The particle size and composition of these quantum nanoparticles can be tuned in order to introduce new properties to the materials. For an experimental evaluation, the comparative studies of different quantum nanoparticles, such as dots, rods and plates were made. The continuous films of all three kinds of quantum nanoparticles were produced and the fluorescence spectra were measured. On comparison between different quantum nanoparticles, the quantum rods showed brightest emission. Afterwards, these quantum nanoparticles were embedded into a high-refractive-index photocurable OrmoClear in order to produce waveguide structures by photolithography technique. The lasing potential of the doped polymer was evaluated by investigating the efficiency of the light propagation through the waveguide. In this case, the optical properties were evaluated based on the concentration of the quantum nanoparticles as well as the structural parameters of the polymers. For the better comparison, these quantum nanoparticles were also embedded into a PMMA (Poly(methyl methacrylate)) powder that can be structured. Additionally, the optical properties of a laser dye, Rhodamine 6G was also evaluated by embedding into these polymers. As a result, Rhodamine 6G was proved to have a narrow absorption spectrum without a sharp emission spectra whereas quantum nanoparticles were seen with a broader excitation spectra and a sharpened emission peak. Quantum nanoparticles were seen more stable whereas in Rhodamine 6G, the effect of photobleaching was high.

Biography

Parva Chhantyal completed her Master's in Chemical Engineering from The University of Manchester, England. She started her PhD in Nanotechnology at Laser Zentrum Hannover, Germany in 2013 and is currently in her third year. Her research focuses on working with different polymers that can be embedded with different fluorescent materials. The ability of these polymers to be structured into a waveguide for the light propagation is the key application.

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