

SYNTHESIS, CHARACTERIZATION AND APPLICATION OF FUNCTIONAL NANOPARTICLES

NANOPHOTONICS RESEARCH GROUP at İYTE

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Nanophotonics research group interested in nanoparticles which can be used in various area such as nanobiotechnology, photovoltaics, and molecular optoelectronics. The research areas of our group can be summarized with three main categories as summarized below.

1. Semiconductor-nanoparticles (Quantum Dots - QD): CdSe/CdS, CdS, CdSe/ZnS, CdSe/CdS/ZnS nanoparticles can be synthesized and characterized. We can control the particle growth of oil soluble QDs with two phase synthetic approach. Recently we focused on water soluble QDs via ligand exchange, directly synthesis or silica coating procedures. Since one of our goal is to use the nanoparticles for nanobiotechnologic applications, we functionalize the nanoparticle surfaces to be bio-compatible. For the other applications such as photovoltaics or light emitting diodes, we collaborate with other research groups.

2. Silica Based Nanoparticles: we synthesize silica based nanoparticles with three different synthetic methods (reverse-micelles, amino acids and Stöber approach). We can control the particle size from 12 nm up to 100 nm. These nanoparticles can be obtained by modification with some fluorescent organic dyes to be bio-compatible materials. Organic dyes can be surrounded by silica cages and prevent from photodegradation in comparison with pristine dye. Thus we can obtain stable, fluorescent and surface functionable nanoparticles for live cell applications.

3. Synthesis of organic based fotonic nanoparticles:

We investigate the application and production of the nanostructures which are formed by self-aggregation. Cyanine and porphyrin dyes are formed nanostructures in nanometers scale. The photonic features of these aggregates show differences from the original dyes depending on some parameters such as dye concentration, temperature and pH. Cyanine aggregates are known to be j aggregates and they are able to sense the potential change on mitochondria surface. Thus it gives information about living cell and organelle functions.

Basic Facilities of Our Laboratories

Our research group established synthesis, cell-culture and spectroscopy and structural analysis laboratories separately. Major instruments are fluorescence confocal microscope (200-250 fps, dual channel) equipped with lasers (488, 514, 532, 635 nm) and a CCD camera for live cell imaging, UV-Vis and fluorescence spectrophotometers, SPM/AFM, XRD, SEM, particle size analyzer for kinetic and structural analysis.