Study of surface ligand in the photoluminescence of water soluble ZnS quantum dots

[*]J. F. Cury[1], L. C. S. Viol[1], K.Balzuweit[2] and M. A. Schiavon[1]
[1]*Universidade Federal de São João Del Rei ,Campus Dom Bosco, Departamento de Ciências Naturais (DCNAT), MG, Brazil*
[2]*Universidade Federal de Minas Gerais ,Departamento de Física-ICEx, MG,Brazil*

Quantum dots (QDs) are semiconductor nanocrystals that have distinctive photoluminescence (PL) properties, which make these materials with great potential for biomedicine applications, such as biological labeling, diagnostics and detection of diseased deep tissues sites of organs and cancer; and technological area in fabrication of lasers, solar cells, nonlinear optical devices and light-emitting diodes (LEDs). [1, 2] Synthesis of QDs having toxic elements such as Cd, Hg and Pb has been overcome by using metals with low toxicity, such as zinc, making these QDs greener. Quantum dots of ZnS, for example, is a non-heavy-metal system with reported photoluminescence in the blue range of the ultraviolet-visible (UV-Vis) spectrum and displays much more less toxicity than the others metals previously mentioned. [3]

In this present work, QDs of ZnS were synthesized using a water-soluble method, in order to obtain nanocrystals with high quantum yield photoluminescence, intense luminescence and solubility in water. To achieve this, it was used different kinds of ligands such as 3-mercaptopropionic acid (MPA), glutathione (GSH), 2-mercaptoethanol (2-ME), 3-mercaptopropyltrimethoxysilane (MPS), thioglycolic acid (TGA), thioglycerol (TG), dodecanethiol (DT) and mercaptosuccinic acid (MSA), which some of the QDs synthesized showed brightly blue light emitting. To have a better known about how the ligands are attached on the nanocrystals surface, they were characterized by UV-Vis, photoluminescence (PL) and infrared (FTIR) spectroscopies. The crystalline phase was determined by X-ray diffraction (XRD) and the morphology of the nanoparticles was determined by transmission electron microscopy (TEM) as quasi-spherical, with diameters lower than 5 nm.

Keywords: quantum dots, semiconductors, ZnS, zinc sulfide, surface ligands.

Work supported by CAPES, CNPq and FAPEMIG.

[1]H.Li, W.Y.Shi, W.H.Shih, Ind.Eng.chem.Res.**49**,578 (2010)
[2] H.Li, W.Y.Shi, W.H.Shih, Nanotecnology. **18**, 495605 (2007)
[3] H.Li, W.Y.Shi, W.H.Shih, Nanotecnology. **18**, 205604 (2007)

E-mail: schiavon@ufsj.edu.br;
Universidade Federal de São João Del Rei, Departamento de Ciências Naturais - DCNAT, Campus Dom Bosco, Praça Dom Helvécio, 74, 36301-160, São João Del Rei, MG, Brazil.