Structural characterization of CdSe/ZnS quantum dots using Medium Energy Ion Scattering

M.A. Sortica[1], P.L. Grande [2], C. Radtke[3], L.G. Almeida[2], R. Debastiani[2], J.F. Dias[2], A. Hentz[2]

mausortica@gmail.com

[1]*Uppsala University, Ångström Laboratory, Department of Physics, Ion Physics, Lägerhyddsvägen 1, Box 516, SE-751 20, Uppsala, Sweden*

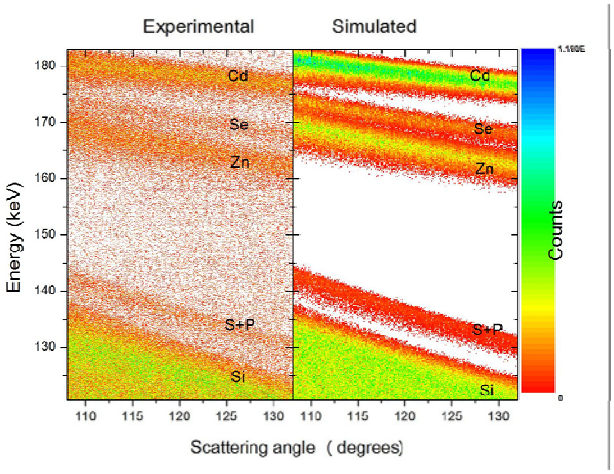
[2]*Institute of physics, Universidade Federal do Rio Grande do Sul (IF-UFRGS), Av. Bento Gonçalves 9500, 91501-970, Porto Alegre-RS, Brazil*

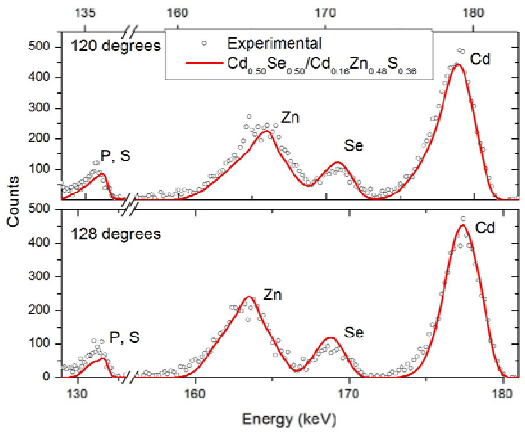
[3] *Institute of chemistry, Universidade Federal do Rio Grande do Sul (IQ-UFRGS), Av. Bento Gonçalves 9500, 91501-970, Porto Alegre-RS, Brazil*

[4]*ANKA/Institute for Photon Science and Synchrotron Radiation (IPS), Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, Eggenstein-Leopoldshafen, D-76344, Germany*

Compound quantum dots QDs are promising materials that can be used in many fields of the technological development, but the accurate knowledge of compositional depth profiling inside of them is still a technological challenge. Medium energy ion scattering (MEIS) is an ion beam analysis technique, capable of elemental depth profiling with subnanometric depth resolution. Recently, the MEIS technique was optimized for nanostructured materials analysis [1] and became a promising tool for structural characterization inside of QDs [2,3].

In this work [4], we use the MEIS technique to characterize a core-shell nanostructure of CdSe/ZnS. The crystal size of 5.2 nm, determined by MEIS, is in good agreement with optical measurements and TEM images. The core-shell structure is resolved by the present configuration of MEIS in contrast to the present TEM measurements. The commercial CdSe/ZnS QDs has non-stoichiometric Cd and Se concentrations. The sample selected for this work have a Cd:Se ratio of 0.69:0.31. Our investigation shows that there is Cd present on the shell and the CdSe core tends to be a stoichiometric crystal. That indicates that, despite the unbalance of material, the CdSe crystal is preserved during the industrial process which allows the control of the QDs diameters.





This study shows that the MEIS technique, combined with other analytical techniques, is a powerful method to determine elemental distribution profiles, inside nanoparticles with diameter about 5 nanometers. This allows studies of the formation and stability of the internal structure of QDs when exposed to several kind of processes, like heating and ion irradiation.

Keywords: MEIS, nanotechnology, IBA, perfilometry

Project financed by CNPq and PRONEX

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