Asesor: Dr. Elder de la Rosa Cruz

Sinodales: Dr. Gustavo Alonso Hirata Flores
(Sinodal Externo – CNyN UNAM, Secretario)

Dr. Efraín Mejía Beltrán
(Sinodal Interno, Vocal)

Dr. Elder de la Rosa Cruz
(Asesor de Tesis, Presidente)

Tesis: **"SYNTHESIS AND CHARACTERIZATION OF OXIDES AND FLUORIDES DOPED NANOCRYSTALS WITH UV-VIS-NIR EMISSION"**

Resumen:

In this thesis is presented a study of structural, morphological and optical properties of lanthanide-doped nanocrystalline oxides and fluorides. Ytterbium (Yb3+), Erbium (Er3+), Gadolinium (Gd3+), Bismuth (Bi3+), Boron (B3+), Europium (Eu3+), Holmium (Ho3+), and praseodymium (Pr3+) doped and co-doped ZrO2, Y2O3, Y2O2S, and NaYF4 were studied under UV and IR excitation. Most lanthanide-doped oxides were prepared by precipitation method combined with a hydrothermal process, and a few by combustion method. The crystal structure was investigated by X-Ray diffraction, and it was obtained tetragonal phase, cubic phase, and hexagonal phase for the lanthanide-doped and codopedZrO2, Y2O3 and Y2O2S, respectively; two mixed phases, cubic and hexagonal were presented in lanthanidesNaYF4. ZrO2: Yb3+, Er3+, Gd3+nanocubes were synthesized with Na2S, where the enhancement of the UC signal with the use of Na2S was the result of the substitution of OH- by SO42- ions on the surface of nanoparticles. While the strong enhancement observed with the introduction of Gd3+ was the result of a forward and backward energy transfer process (Er3+ → Gd3+ → Er3+). Tridoped ZrO2:Yb3+-Er3+-Bi3+ nanophosphors were synthesized and demonstrated the possibility to switch from green-yellow to red emission by switching the excitation from 350nm to 970nm. It was obtained Y2O3: Yb3+, Er3+, M3+ (M3+: Bi3+, Gd3+, Eu3+, Ho3+, Pr3+) nanoparticles with cubic crystalline phase, under precipitation method combined with a hydrothermal process, and combustion synthesis. Besides enhancing considerably the intensity of luminescence, Bi3+ and Gd3+ present own emissions. On the other hand, combining Eu3+and Ho3+, or Yb3+ and Pr3+, it is possible to obtain visible emission in different wavelengths changing the excitation source. Through a modified homogeneous precipitation method combining low-temperature sulfurization process at 625 ºC, it was possible to get Y2O2S:Yb3+, Er3+, M3+with pure hexagonal phase, which favorably enhanced the luminescence intensity of nanoparticles by afactorof33. Most SEM images show uniformly bonded plates forming like a flower with tendency to spherical shape. NaYF4: Yb3+, Er3+ nanoparticles were synthetized by co-precipitation method. DRX patterns showed mixed phases corresponding to cubic and hexagonal phase at 600 ºC. SEM images showed dispersible nanoparticles with smooth and well-formed crystalline forms, most of them had polyhedral shaped blocks with size around 90 nm. It was observed visible (VIS)and near infrared emission (NIR). The color emission could be observed under excitation of a portable laser pointer. Most of synthetized nanoparticles in this thesis could be excited either with IR or UV source in order to get visible emission with a specific primary color (red and green). Interestingly, some nanoparticles show UV and NIR emission. All results demonstrated in this thesis place these nano-oxides and nano-fluorides as excellent candidates in biolabeling as markers for multiplexed detection due to their tuning color properties, in security as anti-counterfeiting effect on inks due to their widely emission range (UV, VIS and NIR), and for this last emission in optical communications.