Synthesis of fluorescent copper clusters

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Metal clusters are groups of a small number of atoms with sizes (≈ 1 nm) similar to the electron Fermi wavelength, resulting in molecule-like behavior including discrete electronic states and size dependent fluorescence. It has been recently shown that transition metal zero-valence clusters having small number of atoms, Mn ($n \leq 20$, n = number of atoms), can be synthesized by simple electrochemical techniques [1]. In this work we will show the synthesis of copper clusters (CuCLs) by an electrochemical method. These copper clusters are stable in acetonitrile and aqueous solutions displaying different photoemission ranges, which can be tuned in the UV and visible region depending on the solvent. These results can be useful to achieve a fine tuning of the fluorescence properties, which is needed for their use in important practical applications, like integrated optical devices, bio-labeling and sensors.

Cu clusters were characterized using UV-Vis and fluorescence spectroscopy, X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM). The obtained results reveal the possibility of tuning the emission range changing the post-treatment conditions.

References:

[1] M.A. López Quintela and J. Rivas. "Procedure for the preparation of atomic quantum clusters". Spanish patent application Nº. P200402041, 2005.PCT/ES2006/070121,2006.

Figures:

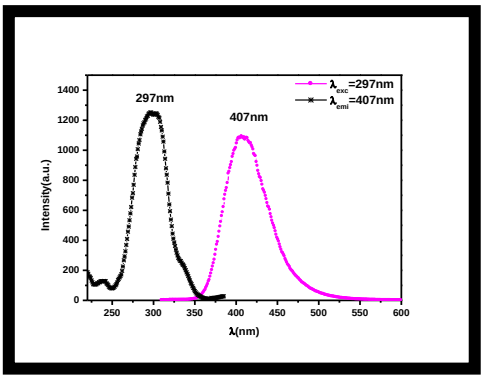

Fig. 1: *Excitation/Emission spectra of CuCLs in water.*

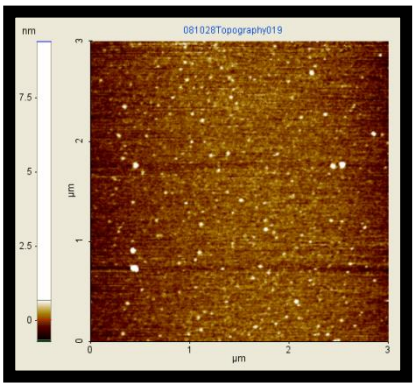

Fig. 2: *AFM image of CuCLs deposited on a mica surface showing an average height of 0.6nm.*