Synthesis, Characterization and Properties of Silver Clusters

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Subnanometric metallic clusters are getting considerable attention recently due to their properties, which are very different from the bulk or nanoparticle ones, offering exciting possibilities for their use in novel materials or devices, in different fields like medicine, magnetism or catalysis [1]. A subnanometric cluster is a metallic molecule having between 2 and ≈ 20 atoms with a fixed geometry and, due to its reduced size, a well-defined bandgap at the Fermi level (larger as smaller is the cluster), which grants them new electronic structure that determine the appearance of completely new properties strictly depending on the size of the cluster. In fact, changes in one or two atoms, will affect the bandgap thus changing completely their properties [2,3, 4]. Therefore, the design of efficient synthetic methods for the size-controlled synthesis of monodisperse samples of clusters is required. Here, we report the electrochemical synthesis of fluorescent Ag clusters in water without any surfactant or protecting agent by using the so-called kinetic control techniques [4]. The main factors affecting the stability and cluster size will be addressed. Clusters were characterized by UV-Vis spectroscopy, Fluorescence Spectroscopy and Mass Spectrometry. The developed synthesis opens up different possibilities for their application in different fields (due to the small bandgap and the low energy position of the HOMO) like visible photocatalysis.

REFERENCES

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FIGURES

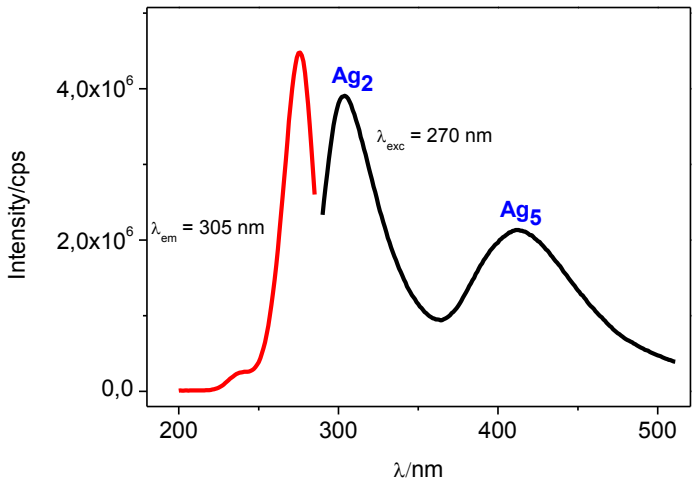

Figure 1: Photoluminescence characterization of a sample of Ag nanoclusters mostly composed by Ag_2 and Ag_5 clusters. Excitation (red line) and emission (black line) spectra.