The surface plasmon resonances are the collective oscillation of the conduction electrons of a metal excited by an electromagnetic radiation. During the last decade, plasmonic properties of metal nanoparticles have been attracted great interest owing to their potential applications in different fields such as electronics, photonics, biotechnology and Raman spectroscopy. Characteristics of the surface plasmon resonances, hence plasmonic properties, are known to be affected by the small modifications in size, shape and composition of the nanostructures, therefore it is essential to be able to directly correlate the surface plasmon resonances with the structural properties at the nanoscale. In this study, we have obtained the in-plane 2D distribution of the surface plasmonic resonances of hollow AuAg nanostructures [1], by means of low loss electron energy loss spectroscopy (EELS) in an aberration corrected scanning transmission electron microscope (STEM), equipped with a monochromator, with sub-eV and sub-nanometer resolutions. The studied complex nanoparticles are nanoengineered from solid Ag cubes to different hollow AuAg nanostructures such as nanoframes and multi walled nanoboxes [1]. We have investigated the local plasmonic property modulations on each nanostructure and correlated them with their structural features. We have also correlated the obtained experimental results with models performed in the frame of discrete dipole approximation.


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Fig. 1: Figure 1: (a) background substracted EEL spectra extracted from the selected areas in the inset EELS SI. (b) is the plasmon energy map between 1.9 and 2.4 eV and (c) shows plasmon intensity maps between 1.8 and 3 eV with 0.2 eV windows (please note that the intensities are normalized for all maps).