

Twinned gold nanoparticles under growth: bipyramids shape controlled by environment

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The control of shape and size of anisotropic gold nanoparticles was at the center of intense research in the last 20 years in regards to their unique physical and chemical properties. If control of size is nowadays achieved, the control of shape remains a difficult task. Questions about the mechanism promoting the anisotropy (in particular when considering the materials crystallizing in bulk in an FCC phase) are still under debate.

In this context, the structure of (Au) bipyramids, very promising for their specific plasmonic properties, was fully analyzed for gradual stages of growth. The atomic structure of the bipyramidal object in formation was extracted thanks to the use of aberration corrected HRTEM, electron tomography. The conservation of a bulk penta-twinned structure inherited from isotropic decahedral (i-Dh) seeds all along the growth is observed for two different synthetic conditions: silver(I)-assisted or without silver seeded growth method. The key role of the initial structure of seeds in the orientation of the final shape is discussed in the framework of a recent atomistic approach developed for metal-environment interactions to account for the stability of multi-twinned nanorods or bipyramids in a complex environment.

"Crystal engineering of Anisotropic Gold nanoparticles through modulation of seed size and structure" Zeliha Cansu CANBEK, thèse UVSQ, décembre 2014