Gold Nanorods vs. Octahedra: Electrochemical interaction with glucose


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The surprising properties revealed by gold nanoparticles (AuNPs) lead continuously to emerging applications over material science. These properties depend on the nanoparticles surface structure and morphology. Therefore the control of the size and the shape of nanoparticles mainly for gold becomes important for understanding the active site at the nanoparticles surface. In this work, single crystal, pentawinned gold nanorods (noted respectively Au-SC-NRs, Au PTW-NRS) and gold octahedra (Au-Octa) exhibiting different facets were prepared. Their physical characterizations revealed the presence of low and high Miller indices (Figure 1A). The electrochemical characterization in the supporting electrolyte show that the formation of oxide layer depends on the AuNPs surface morphology (Figure 1B). This feature was confirmed by the targeted adsorption of 4-mercaptobenzoic acid and the underpotential deposition of lead (UPD-Pb) which is influenced by the crystallographic orientation, especially the low index facets. In the case of glucose electrooxidation carried in alkaline medium, the results clearly demonstrate the difference between the electrocatalytic activity induced by the high and the low index facets. High current densities were observed with Au-Octa, conversely to the behavior stated in the literature. This difference could be attributed to the presence of defects or low coordination sites.

Figure 1. Left) Representative TEM images of single crystalline Au nanorods (top), pentawinned Au nanorods (middle) and Au octahedral (bottom) Right) Cyclic voltammograms of Au nanoparticles in alkaline media

References

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