Does geometry matter in nanoparticle's reactivity towards different molecules?

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Abstract: Developments in controlled nanoparticles synthesis of different metals, has reached the point where the most varied geometries and sizes of a large number of materials have been obtained[1]. By controlling the geometry, it is also possible to obtain different catalytic, photochemical[2] and electrochemical responses[3]. In the present work, cuprous oxide nanoparticles (Cu_2O-NPs) were synthesized obtaining different geometries such as cubes (crystallography type (100)), octahedra (crystallography type (111)) and spheres presenting a mixture of both to crystallographic phases. The average size of all nanoparticles was between 200 – 250 nm.

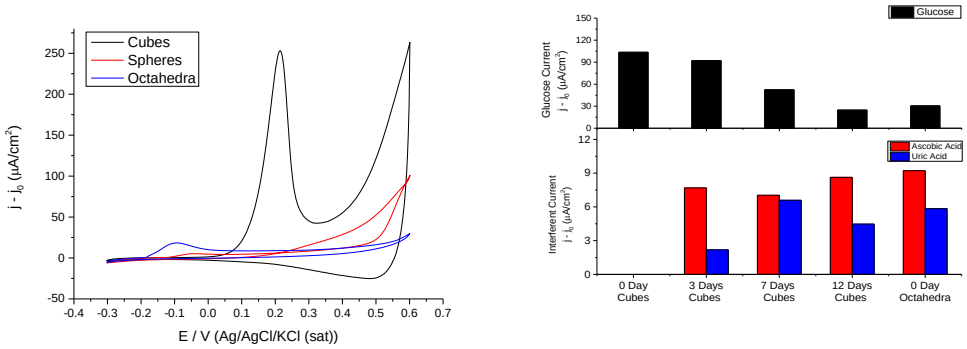

Figure 1. j/E Profiles of different Cu_2O-NPs in NaOH 0.1 mol L^{-1}, v = 10 mV s^{-1}. Current densities for glucose (top panel) and interferents (bottom panel) for cubic Cu_2O-NPs as a function of time after their synthesis. The last point in the curve displays the current densities obtained for freshly prepared octahedral Cu_2O-NPs.

Figure 1 shows different electrochemical responses for each type of geometry. Reactivity test were accompanied by a chronoamperometric analysis for glucose detection, obtaining different behaviors for each type of Cu_2O-NPs, as well as the analysis of some interferents like Ascorbic Acid (A.A.) and Uric Acid (U.A.). Very high selectivity can be observed for the cubic Cu_2O-NPs . It was established a relationship between structural stability and shelf time, which was accompanied by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The importance of the structure and crystallography stability for each Cu_2O-NPs was demonstrated for obtaining high catalytic currents and selectivity for chosen analytes.

Acknowledgments

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References

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