

Mechanism of aldoses electrooxidation at Pt and Au nanoparticles

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The electrooxidation of glucose (GOR) in alkaline media has been extensively studied on bulk platinum (Pt) and gold (Au), because of their high activity. The mechanism generally proposed on both metal surfaces involves the adsorption of glucose on a metallic Pt or Au site (M) through the anomeric followed by an attack of the C-M bond by a hydroxyl anion in solution to produce weakly bonded gluconate species that later desorb in the electrolyte. A second mechanism was proposed for potential higher than +0.600 V vs RHE on Pt and as an alternative path on Au. It consists of the oxidation of the adsorbed dehydrogenated glucose species into δ -gluconolactone. After desorption, δ -gluconolactone is hydrolyzed in the presence of a hydroxyl anion in the electrolyte into gluconate. However, considering that Pt proved to be extremely non-selective compared to Au at low electrode potentials and that the cyclic voltammograms recorded on both materials differ dramatically in terms of shapes and oxidation waves/peaks potentials, one may find very surprising that similar mechanisms are proposed (and accepted) for the glucose oxidation reaction (GOR) on both Pt and Au. These experimental features rather suggest the existence of electrocatalyst-dependent glucose oxidation mechanisms. The present contribution aims at going beyond these uncertainties by providing new insights into the mechanism of the GOR on Pt and Au nanoparticles (Pt-NPs and Au-NPs); it is based on complementary analyses of cyclic voltammograms recorded after chronoamperometry at different potentials, *in situ* Fourier transform infrared spectroscopy (*in situ* FTIR) and differential electrochemical mass spectrometry (DEMS) measurements.