Ultrafast Transient Electrochemical Behavior of Single Nanoparticles

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We have been studying some unique and interesting electrochemical behavior of single metal nanoparticles during their collision on an ultramicroelectrode (UME). In one study, we observed the ultrafast proton reduction and H-adsorption process when single Pt nanoparticles collide on a carbon UME. These reduction and adsorption processes appear as individual sharp current spikes on top of their continuous reduction waves for hydrogen reduction and evolution. In a second study, we saw similar transient current spikes when Pt nanoparticles collide and catalytically oxidize hydrazine (N_2H_4) molecules on a carbon UME. These spikes are likely generated from the catalytic oxidation of the pre-adsorbed N_2H_4 molecules on the Pt nanoparticles upon their collision on the carbon surface. If time permits, I will also describe another interesting observation related to transient formation of nanobubbles and their possible effect on determining the adhesion probability of nanoparticles during their collision on an UME.