The impact of geometric and surface electronic properties of Pt-catalysts on the particle size effect in electrocatalysis

Abstract:
The particle size effect on the formation of OH adlayer, the CO bulk oxidation, and the oxygen reduction reaction (ORR) have been studied on Pt nanoparticles in perchloric acid electrolyte. From measurements of the CO displacement charge at controlled potential, the corresponding surface charge density versus potential curves yielded the potentials of total zero charge (pztc), which shifts approximately 35 mV negative by decreasing the particle size from 30 nm down to 1 nm. As a consequence, the energy of adsorption of OH is more enhanced, that is, at the same potential the surface coverage with OH increases by decreasing the particle size, which in turn affects the catalytic reactions thereof. The impact of the electronically induced potential shift in the OH adsorption is demonstrated at the CO bulk oxidation, in which adsorbed OH is an educt species and promotes the reaction, and the ORR, where it can act as a surface site blocking species and inhibits the reaction. [on SciFinder (R)]