Detection of Chemicurrent on Pt Nanoparticles on Au/TiO_2 Catalytic Nanodiodes under Hydrogen Oxidation

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As hydrogen has been becoming the most promising alternative fuel, understanding chemical dynamics of hydrogen on catalytic metal surface is crucial on fuel cell application. The excess energy released on Pt nanoparticles during exothermic hydrogen oxidation can generates hot electrons which are not in thermal equilibrium. For direct observations of energy conversion during exothermic reaction, we used Au/TiO_2 Schottky nanodiode. Hot electrons are generated on the surface of Pt and go over the Schottky barrier between Au and TiO_2. We found that Pt nanoparticles on Au/TiO_2 nanodiode present chemicurrent during the hydrogen oxidation. By comparing the chemicurrent with the turnover rate, we confirm generation of hot electrons under hydrogen oxidation on the surface of Pt. We measured chemicurrent on Pt nanoparticles with two different sizes, 2.1 and 4.3 nm, to investigate the relation between chemicurrent yield and nanoparticle size. We explain the result in light of mean free path of hot electron passing through nanoparticles and Schottky barrier.