Hot Electron Effect on Metal-Semiconductor Schottky Nanocatalysts

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Among the multicomponent nanostructured materials, hybrid nanocatalysts consisting of metal-semiconductor junctions offer an interesting platform to investigate the role of metal-oxide interfaces and hot electron flows in heterogeneous catalysis. In this study, we report that hot electrons generated upon photon absorption impact the catalytic activity of CO oxidation. In case of Pt-CdSe-Pt nanodumbbells, it exhibited a higher turnover frequency by a factor of two during irradiation by light with energy higher than the bandgap of CdSe, while the turnover rate on bare Pt nanoparticles didn't depend on light irradiation [1]. Pt nanoparticles (NPs) deposited on a GaN substrate under light irradiation exhibit changes in catalytic activity of CO oxidation that depends on the type of doping of the GaN[2]. We also found that the catalytic activity of Au NPs supported on CeO_2 decrea ses during light irradiation although it show some difference with their size. These results imply that hot electron flows generated during light irradiation influence the catalytic activity of CO oxidation, leading to potential applications as a hot electron-based catalytic actuator. [1] S. M. Kim et al, Nano Lett. 13, 1352 (2013), [2] S. M. Kim et al, Faraday Discuss. 162, 355 (2013)