3-in-1 Strategy to Improve both Catalytic Activity and Selectivity for direct H2O2 synthesis: Nonconcentric Pd-Au Nanoparticles

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In catalyst development, one of the biggest scientific challenges is to improve both selectivity and activity all at once. For example, the Pd-Au system is a candidate that has been attracting attention as catalysts of direct H_2O_2 synthesis with better performances than monometallic Pd catalysts. In particular, the incorporation of Au into Pd lattices shows a superior H_2O_2 selectivity (~98%). But, as the content of Au is continuously increased on the surface, the active Pd site gradually disappears. Inevitably, the H_2 conversion capability on the bimetallic catalyst is reduced, thereby lowering H_2O_2 productivity. Thus, enhancing both the catalytic activity and selectivity all at once remains a scientific challenge so far. In this study, we employ the nonconcentric Pd-Au Nanoparticles (NPs) composed of three type surfaces of Pd, Au-rich domains, and Pd-Au interfaces which benefit selective H_2O_2 synthesis. As expected, nonconcentric Pd-Au NPs have very high H_2O_2 selectivity and productivity in comparison to Pd, Pd@Au core@shell, and PdAu alloy.