

Fully Dispersed Metal Ensemble Catalyst to Enhance Low-Temperature Activity

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Maximizing the use-efficiency of precious metal is important in many heterogeneous catalytic applications. Single-atom catalysts (SACs) have received much attention in a decade because all metal atoms can be used for surface reactions. However, SACs cannot catalyze some important reactions which require metal ensemble sites. Here, new metal catalysts were prepared by hydrothermal treatment to 2 wt% Rh/CeO₂. Nearly 100% dispersion was obtained but the surface metal atoms were not isolated (denoted as ENS). ENS showed very high low-temperature activity for C₃H₆ and C₃H₈ oxidations whereas SAC showed no activity, although both catalysts had nearly 100% Rh dispersion. For the simultaneous oxidation where CO, C₃H₆, and C₃H₈ were oxidized together, ENS exhibited superior low-temperature activity for oxidation of all reactants. The surface hydroxyl groups formed on the catalyst help detach Rh atoms, while preventing the re-aggregation of dispersed Rh atoms into Rh particles. This fully dispersed ensemble catalyst would have maximum atom-efficiency while catalyzing various surface reactions.