Direct In Situ TEM Visualization and Insight into the Facet-Dependent Sintering Behaviors of Gold on TiO\textsubscript{2}

Preventing sintering of supported nanocatalysts is an important issue in nanocatalysis. A feasible way is to choose a suitable support. However, whether the metal-support interactions promote or prevent the sintering has not been fully identified. Now, completely different sintering behaviors of Au nanoparticles on distinct anatase TiO\textsubscript{2} surfaces have been determined by in situ TEM. The full in situ sintering processes of Au nanoparticles were visualized on TiO\textsubscript{2} (101) surface, which coupled the Ostwald ripening and particle migration coalescence. In contrast, no sintering of Au on TiO\textsubscript{2} anatase (001) surface was observed under the same conditions. This facet-dependent sintering mechanism is fully explained by the density function theory calculations. This work not only offers direct evidence of the important role of supports in the sintering process, but also provides insightful information for the design of sintering-resistant nanocatalysts.

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