SS-004 <Invited Talk>

Morphology-dependent Nanocatalysis: Rod-shaped Oxides

Wenjie Shen

State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences

Nanostructured oxides are widely used in heterogeneous catalysis where their catalytic properties are closely associated with the size and morphology at nanometer level. The effect of particle size has been well decumented in the past two decades, but the shape of the nanoparticles has rarely been concerned. Here we illustrate that the redox and acidic-basic properties of oxides are largely dependent on their shapes by taking Co_3O_4, Fe_2O_3, CeO_2 and La_2O_3 nanorods as typical examples. The catalytic activities of these rod-shaped oxides are mainly governed by the nature of the exposed crystal planes. For instance, the predominant presence of {110} planes which are rich in active Co^{3+} on Co_3O_4 nanorods led to a much higher activity for CO oxidation than the nanoparticles that mainly exposed the {111} planes. The simultaneous exposure of iron and oxygen ions on the surface of Fe_2O_3 nanorods have significantly enhanced the adsorption and activation of NO and thereby promoted the efficiency of $DeNO_x$ process.

Moreover, the exposed surface planes of these rod-shaped oxides mediated the reaction performance of the integrated metal-oxide catalysts. Au/CeO_2 catalysts exhibited outstanding stability under water-gas shift conditions owing to the strong bonding of gold particle on the CeO_2 nanorods where the formed gold-ceria interface was resistant towards sintering. Cu nanoparticles dispersed on La_2O_3 nanorods efficiently catalyzed transfer dehydrogenation of primary aliphatic alcohols based on the unie role of the exposed {110} planes on the support. Morphology control at nanometer level allows preferential exposure of the catalytically active sites, providing a new stragegy for the design of highly efficient nanostructured catalysts.

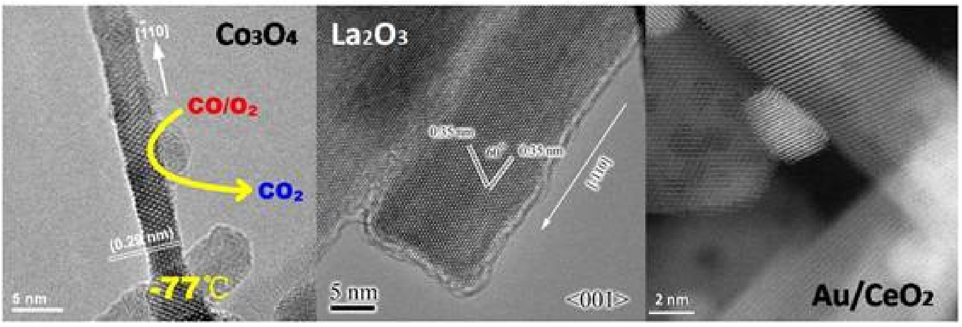

Fig. 1.