Morphology-dependent Nanocatalysis on Metal Oxides

Wenjie Shen*
Dalian Institute of Chemical Physics, CAS
(shen98@dicp.ac.cn*)

Nanostructured metal oxides are widely used in 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 metal oxides are largely dependent on their shape by taking Co_3O_4, Fe_2O_3, CeO_2 and La_2O_3 as typical examples. The catalytic activities of nanorods and nanoparticles of these metal 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. Moreover, the preferably exposed surface planes also alter the dispersion of metal nanoparticles, and thus prompt the reaction performance significantly as observed in the case of gold nanopartlces on CeO_2 nanorods. This sort of approach by morphology control will expedite the development of highly efficient catalysts, which allows preferential exposure of the catalytically active sites.