Morphology-dependent Nanocatalysis in Metal Oxides

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Base transition-metal oxides are not sufficiently active at ambient temperature and are severely deactivated by moisture when they are used for catalyzing low-temperature oxidation of CO, which is widely applied in cleaning air and lowering automotive emissions. Now, nanorod-shaped tricobalt tetraoxide can not only catalyze CO oxidation at a temperature as low as 196 K but also hold substantial stability in the co-presence of moisture. The nanorods of Co_3O_4 predominantly expose the {110} planes, which hold Co^{3+} sites on the surfaces while other planes such as {001} and {111} hold only Co^{2+} sites. Because Co^{3+} sites are catalytically much more active than Co^{2+} sites for CO oxidation, a strong morphology-dependent phenomenon has been observed that the nanorods exhibit markedly (almost one order of magnitude) higher catalytic activity than that of the conventional spherical nanoparticles. Similar phenomenon was also observed in CeO_2 and La_2O_3 nanorods. This sort of approach by morphology control will lead to the development of highly efficient oxidation catalysts of the next generation, which allows preferential exposure of the catalytically active sites.

Keywords. Fuel cell, Oxidation, Catalysis, Gold, Nano particle

References

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