第394回触媒科学研究所コロキウム

Structural Investigation of Combustion Synthesized Cu/CeO2 Catalysts by EXAFS and Other Physical Techniques

P.R.Sarode, Specially Appointed Professor

(ICAT, Hokkaido Univerity)

2016年11月18日(金)13:00—14:30

フロンティア応用科学研究棟セミナー室1

The structure and chemical environment of Cu in Cu/CeO2 catalysts synthesized by the solution combustion method have been investigated by X-ray diffraction (XRD), transmission electron microscopy (TEM), electron paramagnetic resonance (EPR) spectroscopy, X-ray photoelectron spectroscopy (XPS), cyclic voltammetry (CV), and extended X-ray fine structure (EXAFS) spectroscopy. High-resolution XRD studies of 3 and 5 atom % Cu/CeO2 do not show CuO lines in their respective patterns. The structure could be refined for the composition Ce1−xCuxO2−δ(x = 0.03 and 0.05; δ 0.13 and 0.16) in the fluorite structure with 5–8% oxide ion vacancy. High-resolution TEM does not show CuO particles in 5 atom % Cu/CeO2. EPR as well as XPS studies confirm the presence of Cu2+ species in the CeO2 matrix. Redox potentials of Cu species in the CeO2 matrix are lower than those in CuO. EXAFS investigations of these catalysts show an average coordination number of 3 around the Cu2+ ion in the first shell at a distance of 1.96 Å, indicating the O2− ion vacancy around the Cu2+ ion. The Cu−O bond length also decreases compared to that in CuO. The second and third shell around the Cu2+ ion in the catalysts are attributed to − Cu2+ − O2− − Cu2+− at 2.92 Å and − Cu2+− O2− − Ce4+ − at the distance of 3.15 Å, respectively. The present results provide direct evidence for the formation of a Ce1−xCuxO2−δ type of solid solution phase having −□− Cu2+−O− Ce4+ − kind of linkages.

問合せ先: 触媒科学研究所・朝倉清高(askr@cat.hokudai.ac.jp / 011-706-9113)

Prof. Saorde is now a specially appointed professor of Institute for catalysis and a professor emeritus of Goa University. He got PhD from Physical department of Nagpur University, in 1978. Full Professor in Department of Physics, Goa University in 1996 −2011. Dean of Physical Departmen