

390d Role of Cerium for the Stability of CuHM Catalyst by HCl to Reduce NO with NH₃

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Copper ion exchanged mordenite (CuHM) catalyst may be deactivated under NH₃-SCR reaction condition when HCl exists in the flue gas stream, mainly from municipal waste incinerator. The cause of the catalyst deactivation is mainly due to the evaporation of Cu ions from the surface of the catalyst. To enhance the HCl tolerance of the catalyst, cerium was added to the catalyst for stabilizing Cu(II) ion on the catalyst surface. This modification significantly improved the catalyst deactivation by HCl. In particular, for CuCeHM catalyst the loss of copper has been observed at reaction temperature of 450°C, while the loss from the CuHM catalyst without Ce begins at 350°C. Ce simply stabilizes Cu(II) ion on the catalyst surface, generally recognized as an active reaction site for the present reaction system. X-ray absorption near edge spectroscopy (XANES), extended X-ray absorption fine structure (EXAFS), synchrotron radiation X-ray diffraction (SR-XRD), and X-ray photoelectron spectroscopy (XPS) have been employed to confirm the stabilization of Cu(II) ion on the surface of CuCeHM catalyst. Ce less alters the lattice parameter in unit cell of mordenite structure confirmed by SR-XRD and fewer increases Cu(I) ions on the catalyst surface by XPS as clearly observed for CuHM catalyst without Ce during the course of the catalyst deactivation. Ce may decrease the average electronegativity of the catalyst and increase the charge of the lattice oxygen in zeolite framework, resulting in the enhancement of the stability of the Cu-O bond on the surface of CeCuHM in the present catalytic system.