Deactivation of CuSSZ13 for NH_3/SCR reaction by CO_2

민경명, 김영진, 이준규, 홍석봉, 조병권, 남인식*
POSTECH
(isnam@postech.ac.kr*)

The CuSSZ13 has been recently regarded as a commercial urea/SCR (NH_3/SCR) catalyst due to its excellent deNOx activity and hydrothermal stability. However, there has been no systematic study for the effect of CO_2 on the catalytic activity of CuSSZ13, although CO_2 is always present in the exhaust gas stream. In the present study, we investigated the CO_2-induced deactivation of CuSSZ13. The low-temperature deNOx activity of CuSSZ13 gradually decreases upon the inclusion of CO_2 into feed gas stream. Since CO_2 can be readily coordinated to the basic site due to its large quadruple moment, CO_2 and NO competitively adsorb onto the Cu^{2+} ion in CuSSZ13, while the adsorption of NH_3 on the acidic sites of SSZ13 is mostly independent of basic Cu^{2+} sites, as determined by NO- and NH_3-TPD with CO_2. Based on the surface IR study, the formation of nitrate on Cu^{2+} ion known as one of the key steps in the NH_3/SCR reaction is suppressed by the unidentate carbonate, which is believed to be the primary cause for the decline of the deNOx activity over CuSSZ13 by CO_2.