6th International Conference and Exhibition on

Automobile & Mechanical Engineering

July 08-09, 2019 | Zurich, Switzerland

Comparison of hydrocaron components affecting de-nox performance of hc-selective catalytic reduction catalysts

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The catalytic performance of copper (Cu)-containing zeolite catalysts supported on various types of zeolites (chabaziete, MFI, and BEA frameworks) was investigated in the hydrocarbon (HC)-selective catalytic reduction (SCR) of NOx with C_3H_6 and n-C_4H_{10} as reducing agents. The catalysts were prepared by an wetness incipient impregantion method with varying copper loadings from 1 to 10 wt%, thereafter they were washcoated on the commericial monolitic honeycomb substrate. All the prepared powder catalytst were characterized by N_2 adsorption isotherms, powder X-ray diffraction (XRD), inductively coupled plasma–atomic emission spectrometry, solid-state^{27}Al magic angle spinning–nuclear magnetic resonance, ultraviolet–visible spectroscopy, X-ray photoelectron spectroscopy, field emission scanning electron microscopy, and high-resolution scanning electron microscopy. The impregnation of Cu to the respective zeolites did not modify the inherent zeolite topology, whereas the loading levels of copper and zeolite topology significantly affected the de-NOx performance of Cu/zeolites. Among the Cu/zeolite catalysts, 2Cu/ZSM-5 showed the best catalytic performance both the C3H6- and C_4H_{10}-SCR, exhibiting a nearly 70% de-NOx performance at 360^{0}C in C_3H_6-SCR and 74% NOx conversion at 450-465^{0}C in C_4H_{10}-SCR, followed by Cu/BETA and Cu/SSZ-13. The effects of coexistent gases (0-8 vol.% oxygen and 0-10 vol.% carbon dioxide) and hydrothermal aging at 700^{0}C were also evaluated. Oxygen was an indispensable component for the HC-SCR process, and its concentration affected the N_2 selectivity and temperature window of the maximum de-NOx performance. The presence of CO_2 in the feed stream was an inhibitor for NOx reduction.

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