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Reaction mechanism of low-temperature selective catalytic reduction of NOx over iron and manganese oxides supported on fly ash-derived SBA-15 molecular sieves

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Fly ash emissions caused by coal combustion have been increasing for many years causing serious environmental pollution. Coal combustion also causes large amounts of NO_x to be emitted to the atmosphere and this has caused environmental problems such as acid rain, which cannot be ignored. The denitrification catalyst V_2O_5/WO_3-TiO_2 gives good denitrification efficiency at a high temperature but the catalyst gives a poor efficiency at low temperatures (100-300 °C). Therefore, we introduce a new method based on the use of fly ash to control NO_x output. We used a two-step alkali hydrothermal method to prepare SBA-15 mesoporous molecular sieves from fly ash obtained from a thermal power plant in Inner Mongolia (China). A series of bimetallic iron and manganese oxides were supported on the fly ash-derived SBA-15 catalyst and excellent NO conversion was found for NH_3-SCR at low temperatures. The catalysts were characterized by XRD; XPS; NH_3-, O_2- and CO_2- TPD; H_2- TPR, BET analysis, SEM, TEM, and DRIFT spectroscopy. The denitration activity and denitration mechanism over the catalysts is discussed. The mechanisms of NO reduction and N_2O formation over Mn/SBA-15 and Fe-Mn/SBA-15 were investigated through *in situ* DRIFT studies and a transient reaction study. The strong oxidation, low acidity and high basicity of the Fe-Mn/SBA-15 catalyst contributed to a large amount of nitrate being produced during the catalysis. The nitrate decomposed to produce N_2O, resulting in a decrease in N_2 selectivity. The denitration mechanism of the Fe-Mn/SBA-15 catalyst in the SCR reaction followed Langmuir-Hinshelwood, Eley-Rideal and Mars-van Krevelen mechanisms.

Biography

Ge Li has pursued her PhD from China University of Geosciences, Beijing. She is currently working at the National Institute of Clean-and-Low-Carbon Energy in China. She is a Senior Engineer. She has done research on the environmental pollution of the atmosphere, water and solid waste. She has published more than 20 papers in reputed journals and applied for more than 10 Chinese invention patents.

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