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Keywords	Ammonia TPD, Low-Temperature SCR, Manganese Oxides, Palygorskite

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First page example

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A novel MnOx supported palygorskite SCR catalyst for lower temperature NO removal from flue gases

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Keywords: palygorskite; manganese oxides; low-temperature SCR; ammonia TPD

Abstract Palygorskite supported manganese oxide catalysts (MnOx/PG) were prepared for lower temperature selective catalytic reduction (SCR) of NOx by NH_3. Catalyst's SCR activity was estimated at varied temperatures. Catalyst's properties were characterized by XRD, NH_3 adsorption and TPD. Results showed that MnOx/PG catalyst was highly active for SCR at low-temperature. It was also found that NH_3 was mainly adsorbed on palygorskite in two forms. Weakly adsorbed NH_3, which was seldom inhibited by loading of MnOx, but was more favorable to SCR. Whereas strongly adsorbed NH_3 was more likely to be inhibited by MnOx loading but was inessential for SCR.

Introduction

Selective catalytic reduction (SCR) of NOx with NH_3 is an effctive technique for the removal of NOx from flue gases of stationary sources, and the commercial catalyst, V_2O_5 -WO_3 (MoO_3)/TiO_2, has high activity and stability for the use in SCR of NO with ammonia under 350-450 ^oC. However, SO_2 and the high concentrations of ash, e.g., K_2O, CaO and Al_2O_3 in the flue gas, reduce their performance and durability because of this type of catalyst is always placed before dust precipitation and flue gas desulphurization systems. Therefore, the trend is to develop low-temperature catalysts which are capable of working at the end of the exhaust system without reheating. Supported-manganese oxides catalyst, such as MnOx /Al_2O_3 [1,2], MnOx /NaY [3], MnOx /USY [4], MnOx /TiO_2 [5, 6], MnOx-CeO_2 [7,8,9], MnOx /Active-Carbon [10, 11], have attracted substantial attention due to their high low-temperature activitiy of SCR of NO by NH_3. In recent years, a number of reports have reported about the design of DeNOx catalysts, involved the use of pillared clays, which are very active for SCR of NO by NH_3 and more resistant to water and SO_2 than zeolites [12,13]. Other than those pillared clays, fibrous palygorskite clays are potential candidates for a number of processes in heterogeneous catalysis. This class of clay minerals is characterized by porous crystalline structures containing tetrahedral layers alloyed together by longitudinal sideline chains. The ideal formula for palygorskite is Si_8O_{20} (Mg, Al, Fe)$_5$ $(OH)_2$ $(OH_2)_4$•H_2O with Mg preferentially located in octahedral sites. Palygorskite clays depict a high susceptibility to ion exchange, large specific surface area (approximately 120-180 m^2/g), considerable porosity and thermal stability. Acid palygorskite clays, which are potential for using as support of solid-acid catalyst, can be obtained by acid leaching or ion exchange driven by acid cations.

In this work, a novel SCR catalyst was prepared using acid palygorskite as support and manganese oxides as active specie. The performance of this palygorskite supprted MnOx (MnOx/PG) catalyst in lower temperature SCR of NO by NH_3 was investigated. Some factors, such as temperature, Mn loading, were assessed. The catalysts were also characterized by XRD, NH_3 adsorption and TPD.