Selective catalytic reduction nitrogen oxides with methane over nanosized CuO supported on Al_2O_3. Part 2. Catalytic activity and mechanism study

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NO_x is a toxic inorganic gas with a pungent odor under ambient conditions, and is potentially harmful to public health. Moreover, it is known, various technologies have been explored for the reducing NO_x emissions can be classified as wet or dry processes. The use of wet-scrubbing agents to adsorb NO_x enables alkali in water or hydrogen peroxide to be used as the liquid for capturing NO_x. Besides, complete biological treatment systems have been extensively investigated and implemented. Recently, selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) have been established to increase the effectiveness of advanced reduction processes technology using dedicated catalysts, which potentially shorten the reaction times of reduction, and allow it to proceed under milder operating conditions. Supported copper oxides were found to have the high activity among the tested transition metal oxides for the reduction of NO. Hence, the catalytic process of NO_x in a stream to N_2 and H_2O is one method for solving problems of NO_x pollution. This work considers the reduction of NO from by SCR over nanosized Cu/γ-Al_2O_3 catalyst at temperatures between 623 and 1023 K. A nanosized Cu/γ-Al_2O_3 catalyst was prepared by incipient wetness impregnation approach of copper nitrate and γ-alumina support, which were different in the loading of copper. The catalysts were characterized using UV-Vis. Figure 1 presents the effect of copper loading on the conversion of γ-Al_2O_3 at various temperatures. The figure indicates that the maximum activity increases with copper loading in the range of 2 to 8%, and the reaction conditions strongly affect the relationship between the activity of the catalyst and copper content. The lower loadings may offer few active sites and thus showed lower activities. Thus, in this study 8% nanosized Cu/γ-Al_2O_3 catalyst was selected as optimal in the following. Figure 2 shows the bands in the ranges of 300-350 nm and 700-900 nm and were attributed to the $Cu^{2+} - O_2^-$ electronic transition species and the d-d transitions of Cu^{2+} in an octahedral environment with Oh symmetry, respectively.

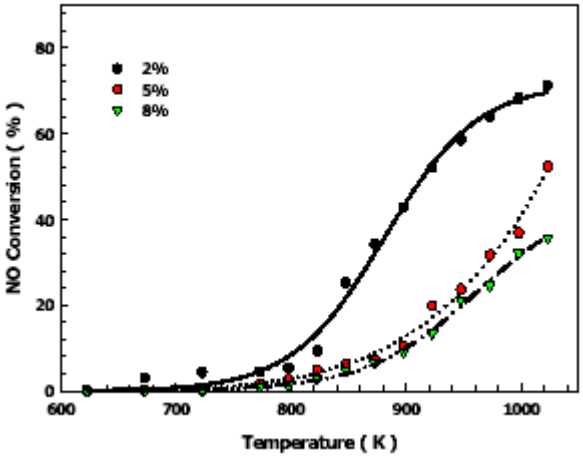

Figure 1. Effect of various copper loading on the nanosized Cu/γ-Al_2O_3 catalyst for the conversion of NO with CH_4. Test conditions : 600 ppm NO in He, 600 ppm CH_4 in He, O_2 = 2%, GHSV = 108000 ml/h-g.

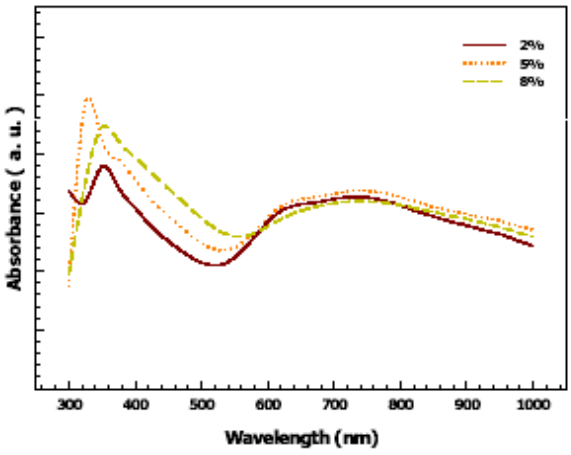

Figure 2. UV-Vis pattern of the various copper loading on the nanosized Cu/γ-Al_2O_3 catalyst.