Reaction characteristics of K-doped Co_3O_4 catalyst with addition of promoter for N_2O decomposition

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N_2O is one of the representative greenhouse gases and the impact of N_2O on global warming is about 10% compared to that of CO_2. However, N_2O is very stable in the atmosphere and remains for 150 years, so the global warming potential (GWP) of N_2O is 310 times higher than that of CO_2 [1]. N_2O reach to stratosphere and destroys the ozone layer. Therefore, it is important to reduce N_2O from emission source and there are various processes such as HC-SCR, NH_3-SCR and decomposition. It was reported that nitrous oxide is easily decomposed to nitrogen and oxygen on various types of catalysts such as noble metals, metal oxide, and ion-exchanged zeolites [2]. Co_3O_4 catalysts have been studied extensively due to their thermal stability and high activity. Especially, it has been reported that the K-doped Co_3O_4 catalysts show the high catalytic activity of the low temperature range.

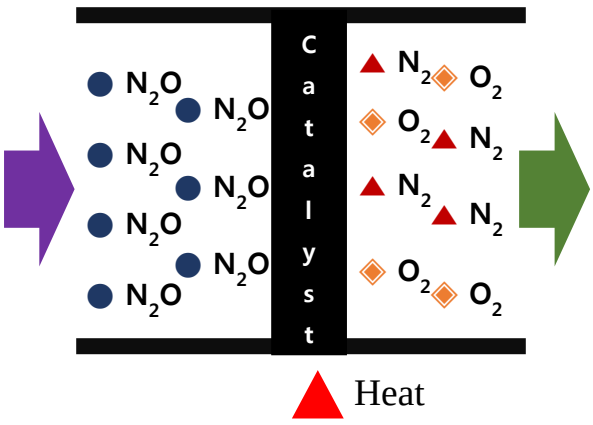

Fig. 1 N_2O decomposition process

In this study, Co_3O_4-promoter catalysts (promoter/Co mole ratio=0.05) were prepared using co-precipitation and K-doped catalysts were prepared by impregnation method. The prepared catalysts were characterized with SEM, BET, XRD, XPS and H_2-TPR. The catalytic activity tests were carried out at a GHSV of 45,000 h^{-1} and a temperature range of 250 to 375 ^oC. Promoter addition in Co_3O_4 catalysts showed high surface area and small size co particles. Also, the doping of K on the Co_3O_4 catalysts reduced the reduction temperature rapidly and had Co^{2+} of high concentration on the catalyst surface. As a result, K-doped Co_3O_4 catalysts showed higher catalytic activity than Co_3O_4-catalysts and it was little effect of promoter for the N_2O decomposition reaction.

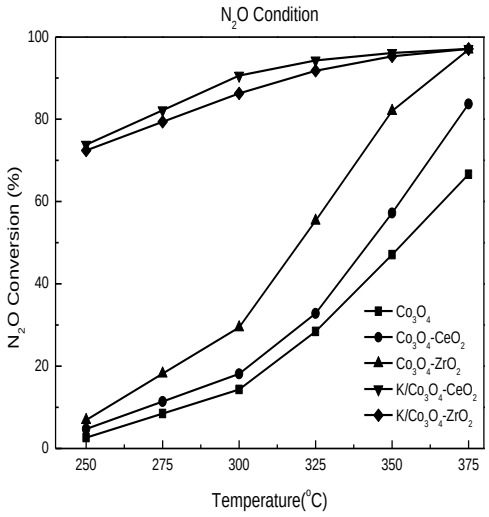

Fig. 2 N_2O conversion performance of K-doped Co_3O_4 catalysts catalysts

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