Effect of Co/Ni ratios in cobalt nickel mixed oxide catalysts for methane combustion

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In this study, we aimed at investigating the effect of Co/Ni ratio of cobalt nickel mixed oxides for methane combustion to effectively reduce unburned methane. A series of cobalt nickel mixed oxide catalysts were prepared by applying co-precipitation method with the varying ratios of Co to Ni. The notation of CoNi (X:Y) was applied to designate the catalyst with the ratio of Co:Ni = X:Y. The catalytic combustion of methane was carried out. In addition, various characterizations were performed such as N2 adsorption-desorption with BET method, ICP-AES, XRD, EXAFS, XPS and H2 TPR to investigate a relationship between structure and activity.

It was found that CoNi (50:50) and CoNi (67:33) catalyst, containing NiCo2O4 spinel structure in largely distorted form, show the superior activity for methane combustion. Such structure disorder contributes to enhancement for the adsorption of surface oxygen species and reducibility of NiCo2O4. It implies that structure disorder plays an important role for the methane combustion. Both characterization and reaction results lead us to the conclusion that optimized cobalt nickel mixed oxide can improve the activity of methane combustion.