In-depth investigation of the synthesis mechanism of novel NO oxidation catalyst $Co/K_xTi_2O_5$

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NO_x abatement is one of the key problems for lean-burn engines, and there is increasing acceptance of the view that the oxidation of NO to NO_2 is an important pre-requisite step for treating emission gases.

In the present work, $Co/K_xTi_2O_5$ catalyst with well-dispersed nano-Co_3O_4 particles, synthesized by an ion exchange method from $K_2Ti_2O_5$ precursor, showed extremely high NO oxidation activity and good stability. Morphological changes and microcosmic processes during the course of catalyst preparation were examined using AAS, XRD and SEM-EDX. During the ion exchange of $K_2Ti_2O_5$ with Co precursor solution, K^+ ions were replaced by H^+ (H_3O^+). After calcination at 500°C, a partially collapsed structure was obtained when the exchange was controlled to a certain degree. Fortunately, the Co that precipitated on this collapsed structure formed highly stable nano-particles of Co_3O_4. Catalytic activity for the NO oxidation was found to be highly dependent on the loading and particle size of Co and K remaining in the $K_xTi_2O_5$ support.