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Effect of catalyst composition and preparation conditions on catalytic properties of unsupported manganese oxides for benzene oxidation with ozone

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ABSTRACT

Catalytic oxidation of benzene in gas phase with ozone was carried out at 70ºC over manganese oxides and manganese-based mixed oxides to investigate the effect of catalyst composition and preparation conditions on their catalytic properties. The oxides were prepared by an evaporation-to-dryness method and a co-precipitation method from metal nitrate precursors, followed by calcination at 400-900ºC. As for manganese monoxides, benzene oxidation rate normalized by catalyst surface area, product distribution and ozone/benzene decomposition ratio were almost independent of the preparation method and calcination temperature. Perovskite-type mixed oxides, $LaMnO_3$ and $La_{0.8}Sr_{0.2}MnO_3$ showed much lower activity and lower efficiency for ozone utilization in benzene oxidation than manganese monoxide and La sites promoted the accumulation of less-reactive byproduct compounds on the catalysts. In the case of manganese-based mixed oxides that contained Fe, Co, Ni, and Cu, benzene oxidation activity, CO_2 selectivity and ozone/benzene