Journal of Alloys and Compounds 493 (2010) 630–635

Contents lists available at ScienceDirect

Journal of Alloys and Compounds

journal homepage: www.elsevier.com/locate/jallcom

Effect of Zr^{4+} doping on the stabilization of ZnCo-mixed oxide spinel system and its catalytic activity towards N_2O decomposition

S.N. Basahel[a], I.H. Abd El-Maksod[a], B.M. Abu-Zied[b], M. Mokhtar[a,*]

[a] *Chemistry Department, Faculty of Science, King Abdulaziz University, Jeddah 21569, Saudi Arabia*
[b] *Chemistry Department, Faculty of Science, Assiut University, Assiut 71516, Egypt*

ARTICLE INFO

Article history:
Received 16 November 2009
Received in revised form
18 December 2009
Accepted 26 December 2009
Available online 4 January 2010

Keywords:
Spinel
Doping
$ZnCo_2O_4$
Activation energy
ESR
N_2O decomposition

ABSTRACT

Cobalt–zinc hydroxycarbonate precursor with nominal Co/Zn atomic ratio of 2 and 0.05–0.15 mol% ZrO_2-doped precursors have been synthesized from their metal nitrate and sodium carbonate by coprecipitation route. $ZnCo_2O_4$ spinel oxide was formed during the precipitation process as complemented by FTIR. Decomposition of the Co/Zn precursor at 350 °C resulted in the formation of $ZnCo_2O_4$ as evidenced by XRD technique. Zr^{4+}-doped samples stabilized the $ZnCo_2O_4$ phase and suppressed the formation of ZnO phase at 550 and 750 °C. The highest surface areas (S_{BET}) were attained for the samples doped with 0.15 mol% ZrO_2. Activation energy of sintering derived from XRD and S_{BET} data was directly proportional to the dopant concentration. ESR results revealed that the addition of increased amounts of Zr^{4+} enhances the formation of Co^{2+} ions. The activity of the 350 and 750 °C calcined catalysts was tested for N_2O direct decomposition. The observed activities were related to the presence of Co^{2+}–Co^{3+} ion pairs which were enhanced by the addition of Zr^{4+} ions.