Effect of the Synthesis Method on the Selective Catalytic Oxidation of Ethylene Glycol over Co-based Spinels

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Cobalt-based spinel oxides have been studied in several reactions such as CO or alcohol oxidation because of their high poisoning resistance, thermal stability and low costs[1]. The synthesis method of Co_3O_4 can produce changes in the morphology, but also in the electronic configuration and valence states of the cobalt ions[2]. Co-based spinels were synthesized by spray flame synthesis and hard templating with SBA-15 and doped with Mn for the selective oxidation of ethylene glycol to glycolic acid in basic conditions. The OH^- concentration is essential for the activity as observed in Fig. 1a presumably due to the proton abstraction from the hydroxyl group and the generation of the active CoOOH layer[3,4]. A volcano-shaped plot has the 1% Mn-doped sample as the most active catalyst for the spray flame synthesis method (Fig. 1b). On the contrary, Fig. 1c shows a clear detrimental effect for increasing amounts of Mn in the spinel structure. No significant changes were observed by applying Raman spectroscopy, XPS or XRD. Therefore, further studies using TEM-EELS[5] and solid-state EPR[6] are needed to demonstrate the differences produced in the electronic structures of Co_3O_4 due to the synthesis methods as well as due the effect of Mn as a dopant.

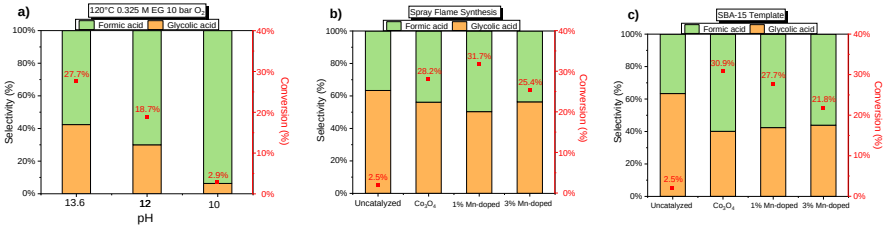

Figure 1. a) pH dependence of the $Co_{2.97}Mn_{0.03}O_4$ performance synthesized by SBA-15 templating. Effect of Mn doping on the catalytic activity of the Co-based spinels at 120°C, 0.65 M KOH, 0.325 M EG and 10 bar O_2 on the b) spray-flame synthesized sample c) on the sample obtained by templating with SBA-15.

References

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