

# Exploring compositional and mesostructural effects of Mn-doped $\text{Co}_3\text{O}_4$ spinel catalysts on the catalytic 2-propanol oxidation

J. P. Fandré<sup>1</sup>, S. Arnold<sup>2</sup>, N. Cosanne<sup>2</sup>, H. Scheele<sup>2</sup>, A. Rabe<sup>3</sup>, E. Budiyanto<sup>1</sup>, S. Najafishitari<sup>2</sup>, H. Tüszü<sup>1</sup>, M. Behrens<sup>2</sup>

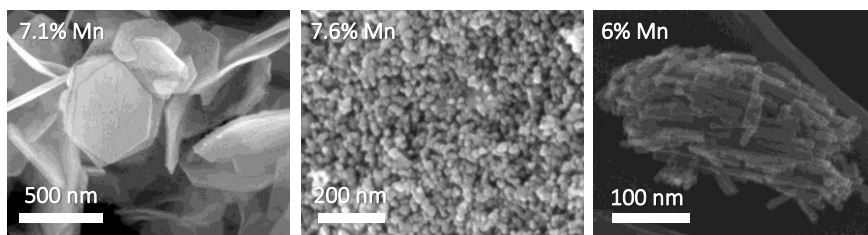
<sup>1</sup>Max-Planck-Institut für Kohlenforschung, 45470 Mülheim an der Ruhr, Germany

<sup>2</sup>Institute for Inorganic Chemistry, Christian-Albrecht University of Kiel, 24118 Kiel, Germany

<sup>3</sup>Faculty of Physics, University of Duisburg-Essen, 45141 Essen, Germany

E-Mail presenting author: sarnold@ac.uni-kiel.de, fandre@kofo.mpg.de

The influence of Mn incorporation into three  $\text{Co}_{3-x}\text{Mn}_x\text{O}_4$  series with unique morphologies and its influence on the electronic structure and catalytic activity was investigated. Two catalyst synthesis approaches were employed namely the crystalline precursor decomposition approach<sup>[1]</sup> and the hard-templating method<sup>[2]</sup>. Single-phase  $\text{Co}_{3-x}\text{Mn}_x\text{O}_4$  catalysts with platelet morphologies (Fig. 1; left) were synthesized via pH- and temperature-controlled co-precipitation of hydroxide precursors and subsequent thermal decomposition. Catalysts with spherical morphologies (Fig. 1; middle) were prepared by applying the same approach using hydroxycarbonate precursors. In addition, phase-pure  $\text{Co}_{3-x}\text{Mn}_x\text{O}_4$  nanowires (Fig. 1; right) were prepared by nanocasting route using SBA-15 silica as a template. When performing nitrogen physisorption, all three sample series showed increasing surface areas with increasing Mn content, with the nanowires achieving the highest surface areas of  $130 \text{ m}^2/\text{g}$  among the series.



**Figure 1:** SEM images of the different  $\text{Co}_{3-x}\text{Mn}_x\text{O}_4$  spinel catalysts. Platelets (left), spherical particles (middle) and nanowires (right).

The catalytic activity and selectivity of these catalysts were then measured in gas-phase 2-propanol oxidation. Preliminary results have already shown promising catalytic activity trends in the dependency of Mn content and morphology.

[1] A. Rabe *et al.*, *Chem. Eur. J.*, 2021, **27**, 17039, 10.1002/chem.202102400.

[2] X. Deng *et al.*, *Chem. Mater.*, 2017, **29**, 41, 10.1021/acs.chemmater.6b02645.