

Investigating thin-film catalyst in Fischer-Tropsch synthesis

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For several decades, Fischer-Tropsch synthesis (FTS) technology has been underpinned by cobalt- and iron-based powder catalyst systems. Nevertheless, due to cost efficiency and lower material requirements, the concept of thin-film cobalt catalysts has emerged as an alternative approach to traditional powder catalysts. In this study, we explore the catalytic performance of Pt-Mn-Co-SiO_x/Al thin-film catalyst under relevant FTS conditions. Thus, the cobalt active metal is deposited onto aluminium foil substrate, by magnetron sputtering. The cobalt layer is stabilized onto the substrate by a metal oxide layer SiO_x -deposited by plasma-enhanced chemical vapor deposition (PECVD). The resulting Co-based thin film is promoted with Mn and Pt resulting in Pt-Mn-Co-SiO_x/Al thin film catalyst. The reduction behaviour of the Pt-Mn-Co system was evaluated using *in-situ* synchrotron GI-XRD conducted at beamline KMC-2 at the BESSY II under H₂ at 350 °C, *cf.* Figure 1a. Ultimately, the prepared thin film catalyst is tested for FTS at 250 °C and 20 bar with H₂/CO ratio of 1.7. CO conversion level of 4% is achieved corresponding to -r_{CO} of 420 hr⁻¹. The olefin product selectivity profile achieved over Pt-Mn-Co-SiO_x/Al thin film catalyst is in agreement with the conventional ASF product distribution, with ethene (C₂) showing lower concentration compared to propene (C₃), *cf.* Figure 1b.

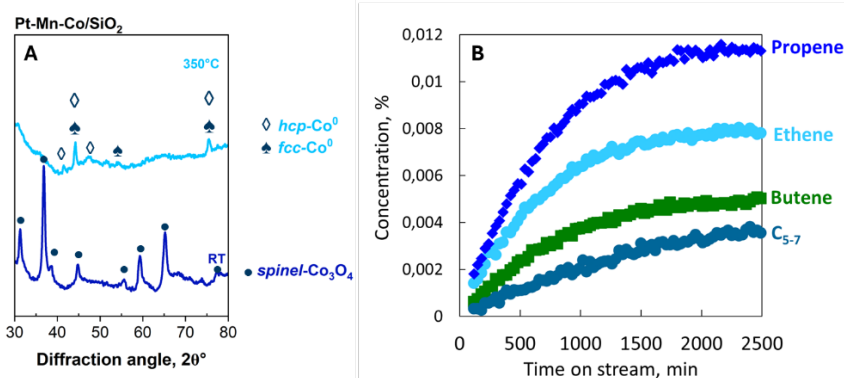


Figure 1. a) Reduction of the Pt-Mn-Co system from *spinel*-Co₃O₄ to a mixture of *hcp/fcc*-Co⁰ at 350 °C. b) Time-dependent olefin product distribution obtained from Pt-Mn-Co-SiO_x/Al thin film catalyst.