

Microsymposium

MS63.O02

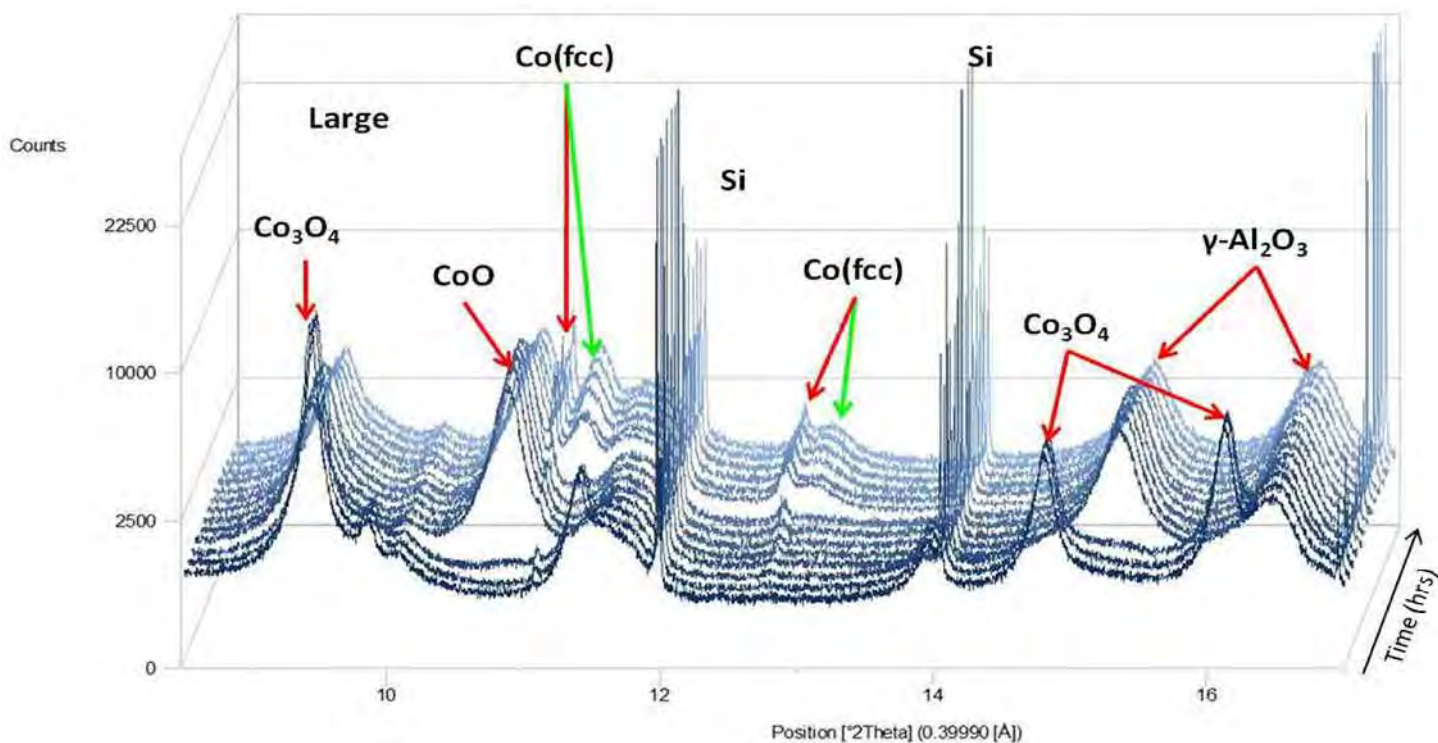
In situ reduction study of cobalt model Fischer-Tropsch synthesis catalyst

H. du Plessis¹, R. Forbes¹, W. Barnard¹, A. Ferreira¹, A. Steuwer²

¹Sasol Technology R&D Ltd, Sasolburg, South Africa, ²MAX IV Laboratory, Lund, Sweden

Fischer-Tropsch (FT) synthesis is an important process to manufacture hydrocarbons and oxygenated hydrocarbons from mixtures of carbon monoxide and hydrogen (syngas). The catalysis process occurs on for example cobalt metal surfaces at elevated temperatures and pressures. A fundamental understanding of the reduction pathway of supported cobalt oxides, and the intermediate species present during the activation, can assist in developing improved industrial supported cobalt catalysts. Measurements were done during in-situ hydrogen activation of a model Co/alumina catalyst using in-situ synchrotron X-ray powder diffraction and pair-distribution function (PDF) analysis. Strong metal-support interactions between the Co and the support¹ can make the catalyst more stable towards sintering. The supported cobalt oxide catalyst precursors have to undergo reductive pre-treatments before their use as FT catalysts. During activation the cobalt oxides evolve, resulting in the formation of metallic cobalt depending on temperature, pressure of activation gases, concentration, time of exposure etc. The effect of hydrogen activation treatments on model catalysts were reported previously [1,2], however analysis of the alumina support phases was excluded from the interpretation by subtraction and normalisation. The PDF refinement accounted for all cobalt present in the catalyst sample and after reduction mainly Co(fcc) with a little Co(hcp) was found to be present. This is a novel approach to in situ PDF analysis of catalysts containing a mixture of phases [3].

[1] Jongsomjit, B., Panpranot, J., Goodwin Jr., J.G., *J. Catal.* 204 (2001) 98-109, [2] Tsakoumis, N.E., Voronov, A., Rønning, M., van Beek, W., Øyvind, B., Rytter, E., Holmen, A., *J. Catal.* (2012) 291, 138-148, [3] du Plessis, H.E., Forbes, R.P., Barnard, W., Erasmus, W.J., Steuwer, A., *Phys. Chem. Chem. Phys.* (2013) 15(28):11640-5



Keywords: in situ XRD, PDF, catalyst