The stability of CO-hydrogenation catalysts can be affected by numerous processes, including sintering and phase transformations such as oxidation and carbide formation. The characterization of these catalysts is often challenging, also due to the air-sensitive nature at their working state. The University of Cape Town, in collaboration with Sasol Technology, has developed an in-situ magnetometer, which allows to study ferromagnetic catalysts at industrial conditions of high temperature (>700°C) and high pressure (>50 bar) [1]. This unique set-up can be used to study phase changes (such as reduction, oxidation and carburization) as well as crystallites size changes. In certain cases even crystallite size distributions of the magnetic phase can be obtained. Importantly, while studying these changes, fully relevant kinetic data can be measured with this flow through fixed bed reactor system so that the catalyst performance can be directly linked to its current state. Examples of investigations conducted with the set-up will be given in the paper; these include inter alia:

- Sintering of a cobalt Fischer-Tropsch catalyst as function of process conditions
- Role of carbides in cobalt based Fischer-Tropsch synthesis
- Crystallite size dependent oxidation of cobalt Fischer-Tropsch catalysts
- Oxidation of Hägg carbide at High Temperature Fischer-Tropsch synthesis
- Sintering of a nickel methanation catalyst at high temperatures
- Passivation of a cobalt catalyst
- Effect on potassium promotion on formation of iron carbide during CO₂ hydrogenation

References: