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Pressure Induced Effects During *in situ* Characterization of Supported Metal Catalysts

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In situ TEM were used to investigate dynamic processes of supported metal catalysts, such as Rh-based catalysts for the synthesis of higher alcohols, where the pressure was varied between a few millibars and atmospheric pressure.

Supported Rh-based catalysts have been widely studied for the synthesis of ethanol and other C_{2+} oxygenates from syngas and show promising activity and selectivity. It is therefore considered as one of the better materials for converting syngas directly into ethanol [1].

Under these *in situ* investigations of Rh-based catalysts, we aim to look into, among other things, strong metal-support interactions (SMSI), see Fig. 1, and to demonstrate the changes that occur at different pressures, which is an important result of the influence of pressure in terms of obtaining the structure-activity correlation for nanoparticles in reaction conditions.

First, we look at the SMSI effect at low pressure (a few millibars), see Fig. 1, using a Cs-corrected FEI Titan 80-300 environmental TEM and a DENSsolutions Wildfire S3 MEMS based heating holder. In order to further understand what happens at higher pressure, a DENSsolutions Climate system was used, where the catalyst can be exposed to the same gas composition at pressures up to 1 bar.

Furthermore, since the high induced electron energies and current densities typically used in HRTEM measurements often causes beam induced dynamic processes, we want to address some of the effects that occur at higher pressures.

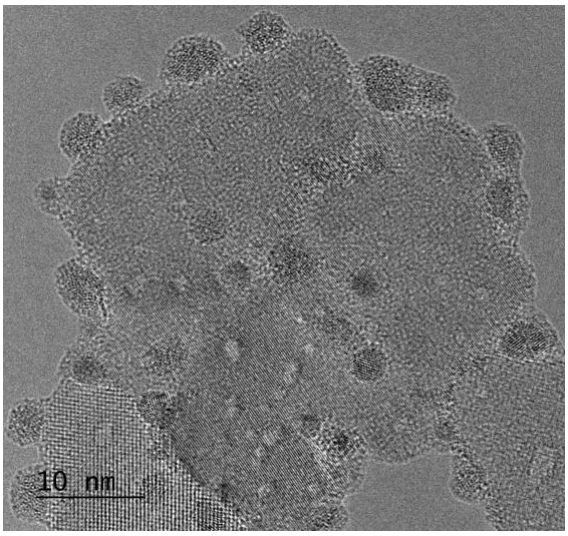

Figure 1: Rh particles on a TiO_2 support in 3 mbar H_2 illustrating the SMSI effect.

[1] V. Subramani and S.K. Gangwal, *Energy & Fuels* **22**, 814–839 (2008).