Understanding the Impact of Reaction Conditions on Methanation Catalyst Structure and Performance using in-situ Total Scattering

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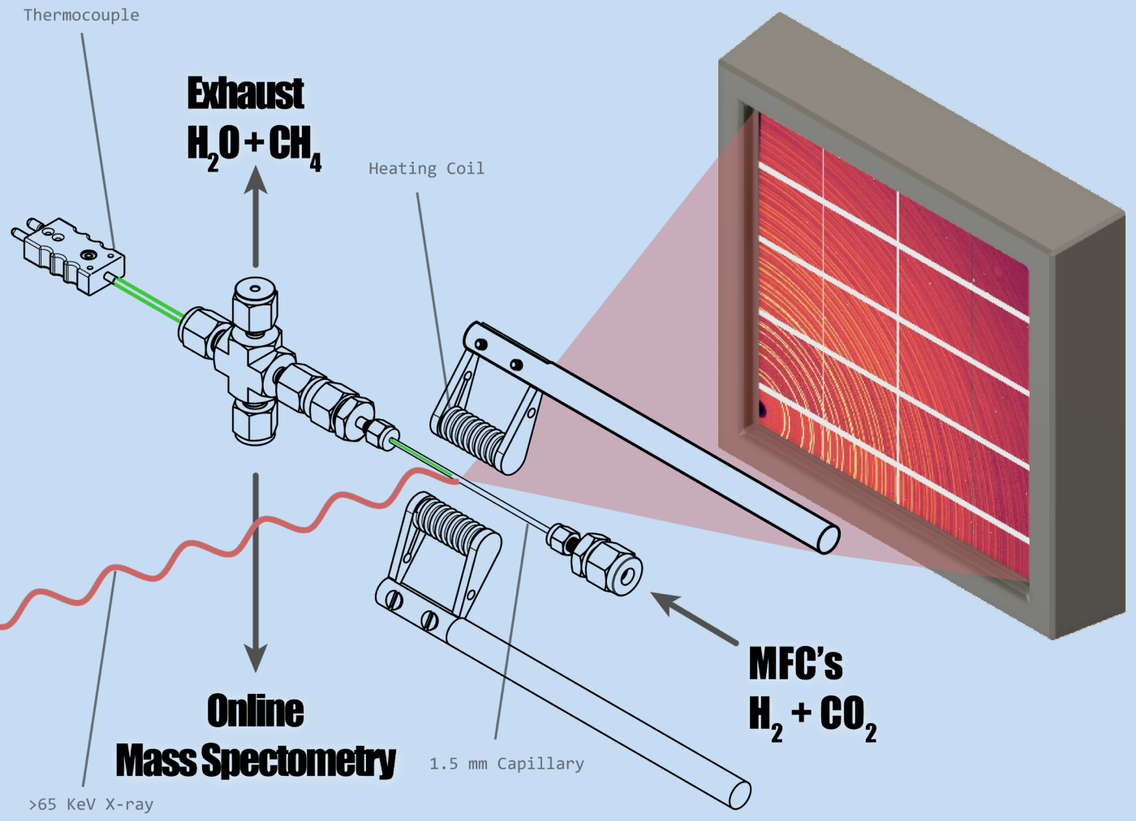
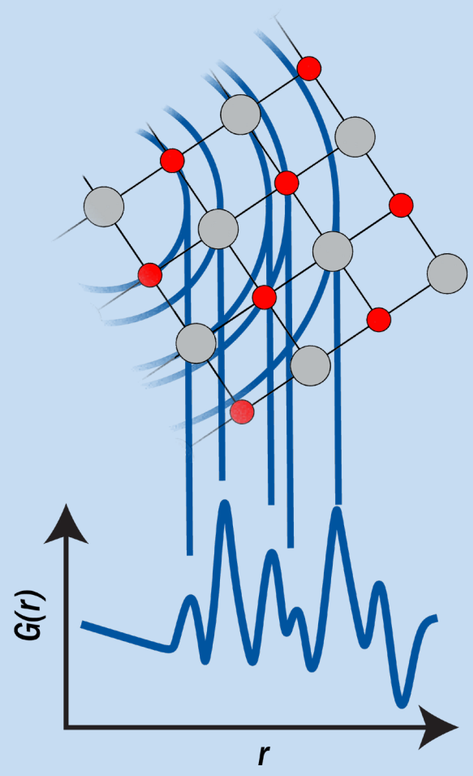


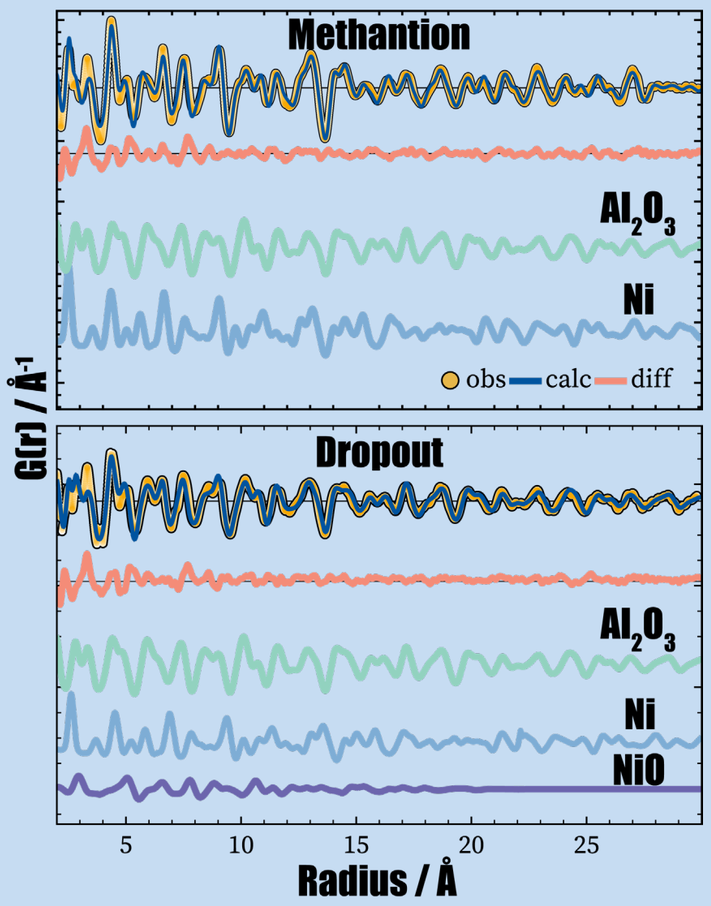
Objectives

- Disorder in Ni@γ-Al_2O_3 CO_2 methanation catalysts under dynamic condtions, using Total X-ray scattering, PDF analysis
- Understanding Structural changes, and their impact on catalytic performance

The Pair Distribution Function

- PDF visually allow visual interpreation of atomic distances as histogram
- Peak width indicates thermal motion; peak height signifies coordination number, overall PDF decay reveals particle size
- Complements conventional XRD analysis; linked through Fourier transform; requirung high Q



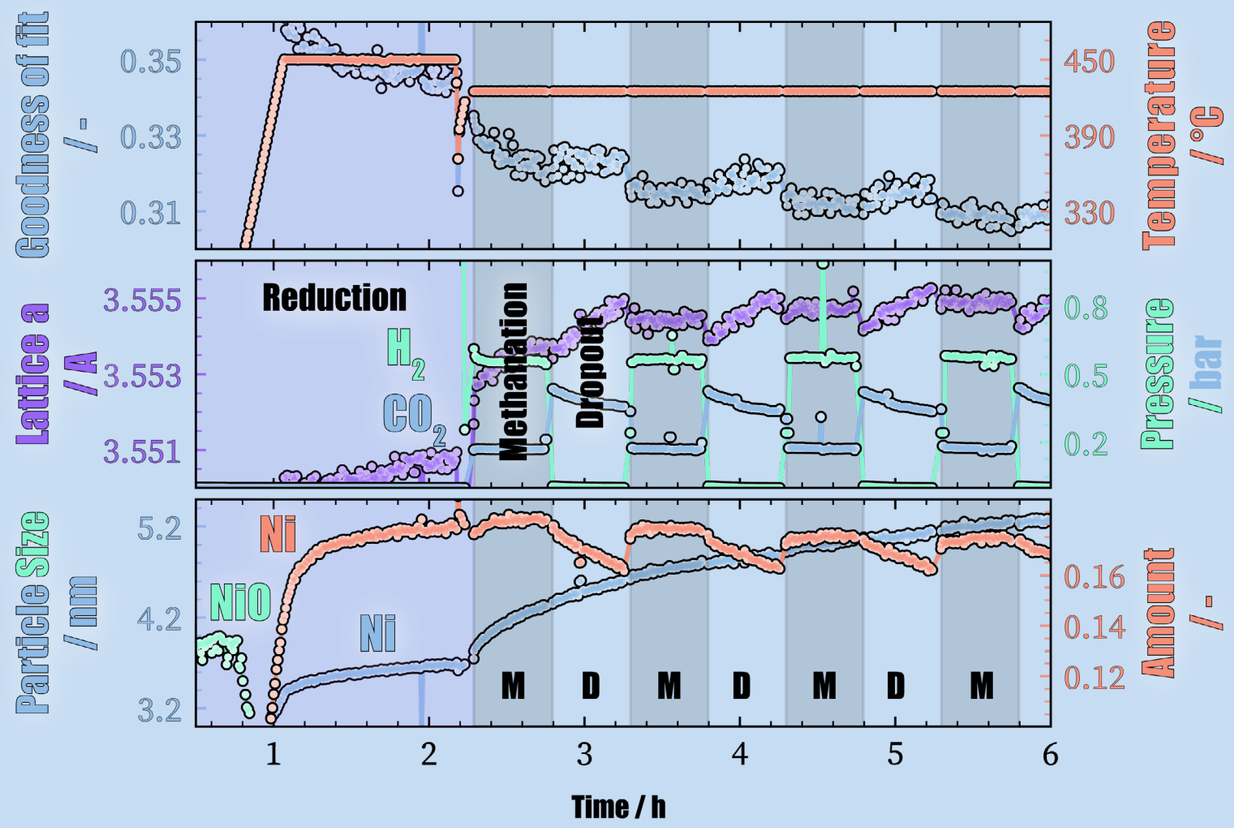


Experimental

- Invesitgation emulating real word contions high pressures, up to 12 bar bars
- Focus on: H_2 methanation with simulated renewable H_2 production using droup-out cycles
- Beam line ID15a at ESRF using 65 KeV

Results

- Achieving a time resolution of 100 ms
- Being able to resoleve 2 nm layers of oxide
- First PDF Methanation Last Dropout
- Growth of Ni from 2nm to 6 nm
- Showing accelerated growth beyond temperature effects but gas composition induced



IfK Institut für Kristallographie

SPP 2080 DynaKat

ESRF The European Synchrotron

FSC The Fuel Science Center

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