	Experiment title: Exploring the active sites and mechanism for the conversion of methane to methanol on Cu-omega	**Experiment number**: 31-01-96
Beamline:	**Date of experiment**: from: 05/09/2018 to: 10/09/2018	**Date of report**: 13/02/2020
Shifts:	**Local contact(s)**: Hermann Emerich	*Received at ESRF:*

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Abstract:
Methane is often flared due to the heavy economic burden of transportation, particularly at rural petroleum extraction sites. Directly converting methane to methanol is possible through a stepwise process with copper-exchanged zeolites. Factors affecting this conversion are not yet fully understood. Omega zeolite (MAZ) can yield 197 μmol per gram-zeolite, the highest reported thus far. Here we show that the synthesis and resulting morphology of the zeolite play an enormous role in the yield of methanol. High yields are only achieved when the zeolite has a longer stick-like bundled morphology (2–4 μm by 100 nm). When the zeolite forms small spherulitic aggregates, the methanol yield is severely diminished (60–97 μmol- methanol per gram-zeolite). This difference originates from minute changes in the synthesis procedure, emphasizing the extreme sensitivity of zeolite properties towards synthesis conditions. This work shows that selecting a parent zeolite is crucial and is an opportunity for process optimization to achieve high and industrially-relevant methanol yields.

A. J. Knorpp, M. A. Newton, V. L. Sushkevich, P. P. Zimmermann, A. B. Pinar and J. A. van Bokhoven, *Catal. Sci. Technol.*, 2019, **9**, 2806–2811.