# Direct Conversion of Methane to Value-added Products Using $N_2O$ Over Fe-based Catalysts

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Abstract:

Direct oxidation of methane to value-added products such as methanol and formaldehyde has received extensive attention in the field of chemical engineering and catalysis[1]. However, current direct methane oxidation processes at high temperature (normally 600°C–900°C) suffer from poor selectivity of $C_1$-oxygenates[2]. Conversely, a high selectivity of desired products were reached by the approaches at low temperature (lower than 200°C), but these routes are not regarded as truly catalytic processes because an additional extraction step is necessary to obtain the products (methanol and formaldehyde)[3]. Therefore, study on methane oxidation under moderate temperatures (300°C) has been carried out, aiming to obtain methanol and formaldehyde in gas phase catalyticlly[4]. However, additional catalyst development is required to enhance the level of methane conversion and desired products selectivity prior to any consideration of industrial application.

In this study, methane oxidation over Fe-based catalysts with a variety of Si/Al ratios at 300°C were investigated. The results showed that methanol and formaldehyde are produced in the gas phase from methane oxidation over Fe-based catalysts, and notable differences in methane conversion and products selectivity over different supports were observed. The results indicate that the conjunction of extraframework Fe and Al is essential for formation of methanol. Besides, different mechanisms were involved in methane oxidation to generate selective products over different catalysts, and the iron species composition might be a most critical factor in establishing the dominate reaction pathway.

Biographical Statement of speaker:

Guangyu Zhao graduated from Southeast University (China) in 2008 in Environmental Engineering, and worked as a research assistant in Southeast University from 2008 to 2014. In March 2015, he began his PhD studies at Newcastle under the supervision of Prof. Eric Kennedy and Prof. Michael Stockenhuber.