Development and Challenges in Methane and Syngas Conversion to Value-added Chemicals

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Development of efficient catalytic technologies to convert methane and syngas to high value-added chemicals and fuels is essential for optimal utilization of fossil resources. We recently reported an OX-ZEO catalyst design concept, which enables direct syngas conversion to a variety of chemicals such as mixed light olefins, ethylene, high octane number gasoline and aromatics with selectivities surpassing those in conventional FTS. For methane conversion, the direct route remains a challenge and is long considered as a Holy Grail of chemistry. Despite the challenges, there is significant progress recently. The pioneering work includes those of Keller and Bhasin in the 1980s, converting methane to C2+ hydrocarbons via oxidative coupling (OCM), Wang et al. in 1993 reporting methane dehydroaromatization (MDA) and Guo et al. in 2014 using the lattice-confined single sites catalyzing methane conversion to ethylene and aromatics (MTOAH) under nonoxidative conditions.