**Catalytic Transformation of C1 Gases to Value-Added Chemicals**

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The utilization of C1 gases, such as methane, carbon monoxide, and carbon dioxide, has been attracting great attention as a critical challenge for addressing global issues on fossil fuel depletion. Also, methane and carbon dioxide are known as greenhouse gas that contributes 35% of overall greenhouse effect, and thus causes serious climate change. However, both methane and carbon dioxide is highly stable due to the strong bonding energy of C-H and C-O, respectively, making them hardly transformable to any other chemicals. In order to tackle this, many strategies have been developed for catalysis by enzymes (mimics) and catalysts. However, the catalytic activity in terms of conversion and yield for desired products is still remain as a challenge. In this talk, some case studies on heterogeneous catalysts for utilization of each methane and carbon dioxide and both together to value-added chemicals, such as methanol, formic acid, and acetic acid, will be delivered with emphasis on mechanistic insight how the catalytic activity could be controlled. Non-precious metals such as Cu, Fe, Zn, Ce, and etc., were employed as active site for each reaction. Various surface spectroscopic tools including NMR, FT-IR, and XPS, and ab initio calculations (DFT) were conducted to deduce plausible mechanism of catalytic transformation of C1 gases over heterogeneous catalysts.