Quantitative Synthesis of Acetic Acid by Methane Conversion: A Kinetic and Mechanistic Insight

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C1 compounds like CH_4 and CO_2 are the major gases causing greenhouse effect Because of their inertness, mechanistic and kinetic information have to be revealed in order to understand critical steps involved in conversion. Herein we are revealing most important mechanistic and kinetic information to give better understanding and to achieve co-conversion of these gases into valuable chemicals. ZnO and CeO_2 supported on montmorillonite catalyst was employed as catalyst for co-conversion of CH_4 and CO_2 to form acetic acid. It was revealed that the gas adsorption step on the active sites is rate determining step and formation of acetate is the faster step involved in the formation of acetic acid. Our concept to provide individual active sites in catalyst for different gases and choosing metal atoms having bigger atomic size carbonylating properties were kinetically favored the reaction proving higher methane conversion and yielding increased amount of acetic acid. This work was supported by NRF funded by the Ministry of Education (Grant number: NRF-2013R1A1A2060638).