

New $\text{SiO}_2@V_2O_5@Al_2O_3$ core@shell catalysts for selective oxidation of methane to formaldehyde양의섭¹, 이준경¹, 김동현^{1,2}, 정윤석², 곽자훈¹, 박은덕³, 안광진^{1,†}¹울산과학기술원; ²한양대학교; ³아주대학교(kjan@unist.ac.kr[†])

As a technology that utilizes abundant natural gas resources, it is very important to develop catalysts that directly convert methane into high value-added chemicals. Stable molecular structure and high C-H bond dissociation energy require excessive thermal reaction conditions, and these harsh thermal system produces additional carbon dioxide due to overoxidation. Herein, we develop the novel $\text{SiO}_2@V_2O_5@Al_2O_3$ core@shell nanostructure as a catalyst for selective oxidation of methane to formaldehyde. The new core@shell catalysts are prepared by the hydrothermal synthesis and subsequent atomic layer deposition (ALD). The core $\text{SiO}_2@V_2O_5$ nanostructures are coated by Al_2O_3 shell through multiple ALD cycles, enhancing catalytic activity and thermal stability in the methane partial oxidation. The highest catalytic activity (CH_4 conversion = 22.2%; HCHO selectivity = 57.8%) at 600 °C is shown in the core@shell catalyst prepared by 50 ALD cycles. *In situ* XRD, H_2 -TPR, Raman, and UV-Vis characterizations demonstrate that the new T_d monomeric vanadium species with V-O-Al bond is responsible for the high methane conversion.