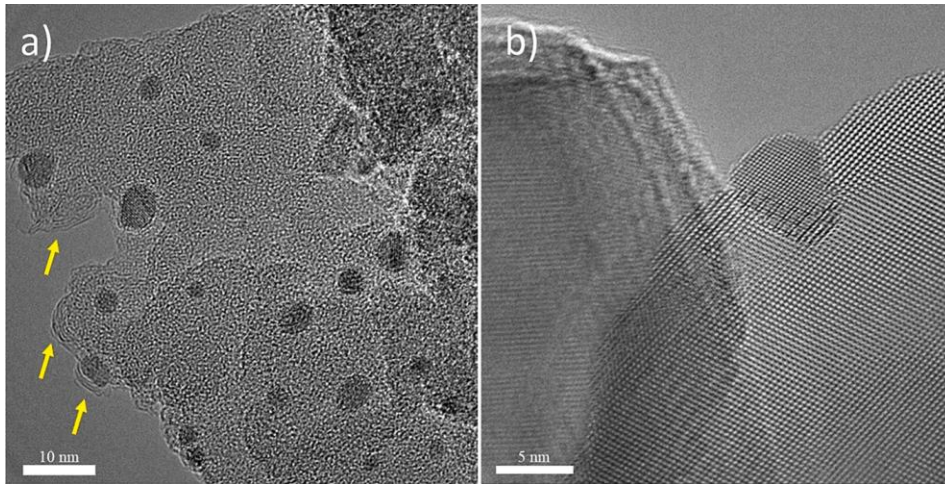
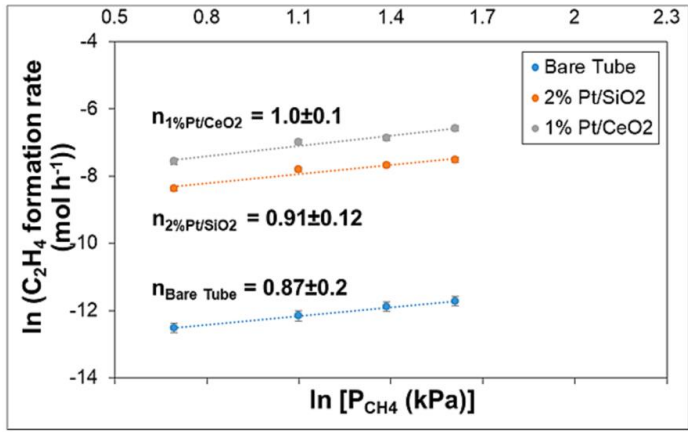
Evolution of Single Atom Pt Sites during Non-oxidative Coupling of Methane





HR-TEM images of spent a) 2 wt% Pt/SiO2 and b) 1 wt% Pt/CeO2 catalyst, and NOCM Kinetic studies.

Scientific Achievement

Microscopy and spectroscopy were used to understand the nature of Pt single atom active sites during non-oxidative coupling of methane (NOCM).

Significance and Impact

NOCM converts methane to higher hydrocarbons and elucidating the mechanism and is critical for the development of shale gas and tight oil reserves.

Research Details

- Single atom Pt on CeO_2 and Pt nanoparticles (~2nm) on SiO_2 show similar ethylene formation rates.
- Pt found to sinter to particles approximately 5–7 nm in size, suggesting that single atoms do not survive industrial NOCM reaction conditions.
- Study suggests Pt single atoms are not the active sites for NOCM.

Talpade, A. D.; Canning, G.; Zhuchen, J.; Arvay, J.; Watt, J.; Miller, J. T.; Datye, A.; Ribeiro, F. H. Catalytic Reactivity of PT Sites for Non-Oxidative Coupling of Methane (NOCM). *Chemical Engineering Journal* **2024**, *481*, 148675.