ARRADIANCE *Sneak Preview*

Synthesis of Pt_3Zn_1 and Pt_1Zn_1 intermetallic nanocatalysts for dehydrogenation of ethane

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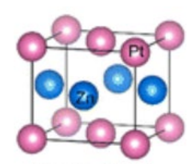
Dehydrogenation of alkanes has historically been cost prohibitive, though of interest to produce more reactive lower alkenes containing less carbon for the rapidly expanding polyolefin polymer industries. Lower alkanes are readily available feedstocks from petroleum and gas resources. The main challenge of using lower alkanes to produce value-added chemicals is the development of economic and environmentally friendly processes that would overcome low reactivity of alkanes, thus avoiding high temperature, high pressure or aggressive co-reactant chemical processing which requires large capital investments. Industrial applications for this process include production of ethylene from ethane, propylene and isobutylene from propane and isobutane, and of styrene from ethylbenzene.

In the presence of a *suitable catalyst*, dehydrogenation can be carried out with minimal cracking of the hydrocarbon. Various Pt-based intermetallic nanocatalysts, such as Pt–Zn, Pt–In, Pt–V, and Pt-Sn have demonstrated enhanced activity and selectivity in alkane dehydrogenation, because they yield the desired alkene of *polymer-quality purity* rather than a mixture of products caused by breaking of C-C bond in side reactions. Scientists from the University of Alabama and Argonne National Lab (ANL) report[1] new progress in creating Pt-Zn intermetallic nanoparticles on powder silica by employing atomic layer deposition (**ALD**) technique. They first grew ZnO by ALD in a highly controlled and uniform manner and followed it by incipient wetness impregnation (IWI) of Pt, and hydrogen reduction to form Pt_3Zn_1 or Pt_1Zn_1. Intermetallic nanoparticle sample chemistry and crystal structure was extensively characterized at ANL by a combination of spectroscopic and high-resolution electron microscopy techniques, to verify size distribution and purity of resulting nanocatalysts, and kinetics under H_2 reduction via *in-situ* X-ray synchrotron electron spectroscopy (XES). It was also confirmed that Pt_1Zn_1/SiO_2 exhibited a much higher efficiency in conversion of ethane to ethylene than Pt_3Zn_1/SiO_2 and Pt/SiO_2, and considerably enhanced stability.



$Pt_1Zn_1(L1_0)$

[1] Zh. Gan, et. al., **Phys. Chem. Chem. Phys.**,2023, **25**, p.7144 DOI: 10.1039/D2CP04173A

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