

Hydrothermal Synthesis of Highly Cross-linked PtZn@Silicalite-1 Structured Catalysts for Propane Dehydrogenation

Liming Xia¹, Bofeng Zhang¹, Gang Hou¹, Li Wang¹, Sibao Liu¹, and Guozhu Liu¹

¹Tianjin University

March 11, 2024

Abstract

Structured catalysts coatings exhibit excellent performance on non-adiabatic gas-solid process, deriving from their enhanced heat and mass transfer properties. However, the coating catalysts prepared by traditional hydrothermal method of zeolite encapsulating noble metal are prone to spalling, especially under conditions of large flow rate and high temperature. Herein, we prepared PtZn clusters encapsulated in silicalite-1 zeolite coating on stainless steel with high bonding strength by an improved in-situ growth method. The optimized catalyst exhibited ultra-thin, uniform, continuous, and high degree of crosslinking, thereby enhancing mass transfer and thermal stability. In propane dehydrogenation reaction (PDH), the optimized PtZn@S-1-R showed a high specific activity of 14.7 molC₃H₆-molPt-1-s-1 and a propylene selectivity above 99% at 600 °C with a high weight hourly space velocity (WHSV) of 120 h-1. The metal-encapsulated zeolite coating catalysts open up a new avenue for heterogeneous catalysis with great application prospects.

Hosted file

Manuscript.docx available at <https://authorea.com/users/753741/articles/723876-hydrothermal-synthesis-of-highly-cross-linked-ptzn-silicalite-1-structured-catalysts-for-propane-dehydrogenation>