

Study on deactivation of Ni/Al₂O₃ catalyst for liquid phase hydrogenation of crude 1,4-butanediol aqueous solution

The deactivation of a commercial Ni/Al₂O₃ catalyst in the liquid phase hydrogenation of crude 1,4-butanediol aqueous solution was investigated. H₂-TPD experiments have been performed over the fresh and deactivated catalysts in order to determine the change in metal dispersion. In this experiment the gaseous products were monitored as a function of temperature using a HIDDEN model QIC-20 mass detector.

The TPD profiles are shown in figure 1. The profiles show two domains of H₂ peaks, one below 623K referred to as type-1 peaks and the other between 623K and 823K denoted as type-2 peaks. The low temperature type-1 peaks are generally attributed to H₂ desorbed from the metal particles and indicates the exposed fraction of Ni atoms. It could be seen that the type-1 peak area for the fresh catalyst was much larger than that for the deactivated one. This indicates that aggregation of Ni occurs in the deactivated catalyst leading to a decrease in the amount of chemisorbed H₂. The high temperature type-2 H₂ peak corresponding with a CO₂ peak between 623K and 873K existed just in the deactivated catalyst. It was attributed to the pyrolysis of the oligomeric species deposited on the deactivated catalyst during the reaction.

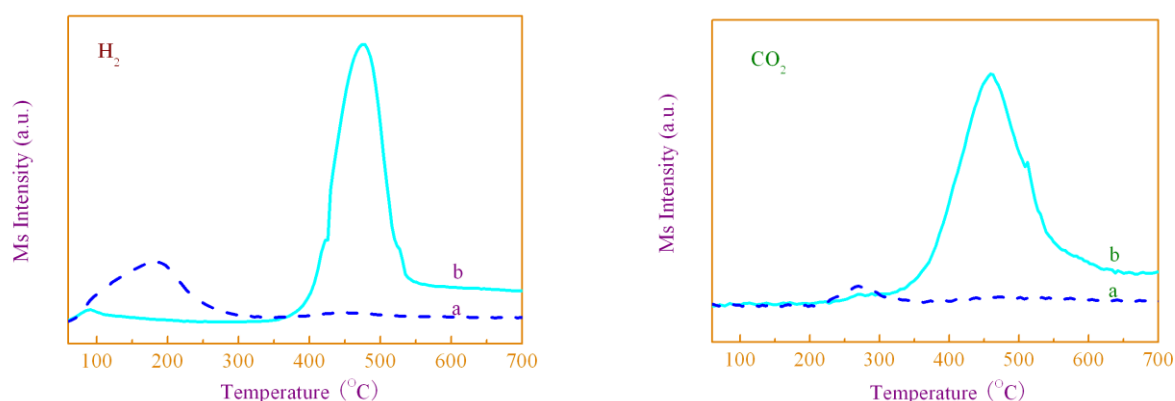


Fig 1. TPD profiles of fresh (a) and deactivated (b) Ni/Al₂O₃ catalysts.

Project Summary by:

Yongxiang Zhao & Haitao Li

School of Chemistry and Chemical Engineering, Engineering Research Center of Ministry of Education for Fine Chemicals, Shanxi University, Taiyuan 030006, Shanxi, PR China



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HIDEN ANALYTICAL LTD

420 Europa Boulevard, Warrington, WA5 7UN, England

t: +44 (0) 1925 445225 f: +44 (0) 1925 416518

e: info@hidden.co.uk w: www.HiddenAnalytical.com