MASTER'S THESIS

Arsenic poisoning of nickel catalysts

Ye, Hui

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Arsenic Poisoning of Nickel Catalysts

YE Hui

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ABSTRACT

To better understand the mechanism of the Ni/SiO_2 catalyst poisoning by arsenic is one of main purposes of this project. Various methods are used in this studies..

A flow desorption system and TEM was used to measure the metal dispersion and particle size of the Ni/SiO_2 catalyst. It shows that the Ni/SiO_2 catalyst is well dispersed, and possesses a superparamagnetic property examined by using Weiss extraction method.

Weiss extraction system is the main tool used in this project. It was also used to measure the B.N. of adsorbates, such as AsH_3, H_2, CO and C_2H_4, and to observe the interaction between adsorbates and nickel. It indicates that adsorption of AsH_3 on Ni/SiO_2 catalyst occurs dissociatively, and a bond number of 5 is obtained. For adsorption of CO and C_2H_4 on clean sample, the bond number is 2 and 8 at low coverage, respectively. On the poisoned sample, the bond number depends on the coverage of AsH_3. It also indicates that the adsorbates, such as H_2, CO and C_2H_4, may induce the migration of As into bulk.

A flow reaction system is used to examine the effects of arsenic on the activity and selectivity of the Ni/SiO_2 catalyst for the H_2/CO reaction. Results show that increasing the amount of adsorbed AsH_3 up to 22.5 ml(STP) do not cause a significant decrease in activity, and the selectivities to CH_4, C2 and C3 are not affected by arsenic. One speculates that the segregation of arsenic into bulk may occur during CO hydrogenation. XPS results show that the bulk of the samples after use for activity test is attacked by arsenic.

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