

## MASTER'S THESIS

### Arsenic poisoning of nickel catalysts

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# **Arsenic Poisoning of Nickel Catalysts**

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## ABSTRACT

To better understand the mechanism of the Ni/SiO<sub>2</sub> 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<sub>2</sub> catalyst. It shows that the Ni/SiO<sub>2</sub> 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<sub>3</sub>, H<sub>2</sub>, CO and C<sub>2</sub>H<sub>4</sub>, and to observe the interaction between adsorbates and nickel. It indicates that adsorption of AsH<sub>3</sub> on Ni/SiO<sub>2</sub> catalyst occurs dissociatively, and a bond number of 5 is obtained. For adsorption of CO and C<sub>2</sub>H<sub>4</sub> 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<sub>3</sub>. It also indicates that the adsorbates, such as H<sub>2</sub>, CO and C<sub>2</sub>H<sub>4</sub>, 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<sub>2</sub> catalyst for the H<sub>2</sub>/CO reaction. Results show that increasing the amount of adsorbed AsH<sub>3</sub> up to 22.5 ml(STP) do not cause a significant decrease in activity, and the selectivities to CH<sub>4</sub>, C<sub>2</sub> and C<sub>3</sub> 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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