

**E2-33 Effect of MgO on carbon deposition over a Ni/Al<sub>2</sub>O<sub>3</sub> catalyst, an investigation by FTIR**

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A highly active catalyst for hydrocarbon oxidation was prepared using Ni (25% w/w) as the active material. The effect of MgO on carbon deposition was studied by using supports of the form MgO/Al<sub>2</sub>O<sub>3</sub>. Catalytic activities of the synthesized catalysts were tested by measuring cyclohexane oxidation under

oxygen limited conditions (Oxygen was sufficient to completely oxidize only ~ 12% of cyclohexane). Under such conditions Ni catalysts are subjected to high carbon deposition. The conditions were selected to investigate the effect of the second metal ion on carbon deposition.

Among the catalysts tested Ni/MgO and Ni/Mg/Al<sub>2</sub>O<sub>3</sub> catalysts showed the highest activity and the highest resistance to carbon deposition. The effect of the second metal ion depends on the amount of the metal ion added. In the case of Mg as the second metal ion in Ni/Mg/Al<sub>2</sub>O<sub>3</sub> type catalysts a 10% w/w loading of Mg was necessary to see a significant reduction of carbon deposition. Fourier Transform Infra Red (FTIR) investigation of the catalysts (Ni/MgO, Ni/Al<sub>2</sub>O<sub>3</sub> and Ni/MgO/Al<sub>2</sub>O<sub>3</sub>) showed that the carbon deposition originates with a lay down of unsaturated hydrocarbon residues. This was observed as a growth of an IR band in the region of 1200-1800cm<sup>-1</sup>. When the reaction was carried out at 600°C, the Ni/Al<sub>2</sub>O<sub>3</sub> catalyst became opaque to IR beam indicating heavy carbon deposition. However, such an observation was not made with Mg containing catalysts. The carbon deposition was in the order Ni/Al<sub>2</sub>O<sub>3</sub>>Ni/MgO/Al<sub>2</sub>O<sub>3</sub>>Ni/MgO>MgO. Modifying the support with suitable metal ions can significantly lower carbon deposition over Ni containing catalysts.

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