

**FALL 2007 SEMINAR SERIES**

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**Date: Tuesday, October 23, 2007**

**Time: 2:00 pm - 3:00 pm**

**Room: SL 220a**

**Reception at 1:45 pm (cookies and refreshments served)**

**Everyone is invited**

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**Nano Cobalt Catalysts for Fischer-Tropsch Synthesis to Clean Fuels**

**Dr. Wei Chu, Professor of Chemistry and Chemical Engineering, Sichuan University, China**

**Abstract.** Production of synthesis gas from methane or coal and the conversion of syngas to a range of fuels and chemicals could become of great interests, while the reserves of crude oil are depleted and the price of crude rises (more than 80 US\$/bbl). For the Fischer Tropsch catalyst design and preparation, numerous parameters should be taken into account for a better performance.

Several series of Al<sub>2</sub>O<sub>3</sub> supported nano cobalt catalysts were prepared by incipient wetness impregnation followed by drying and calcination at the temperatures ranging from 200 to 500 °C; some were enhanced with plasma technique. The catalysts were investigated by thermal analysis (TGA and DTA), X-ray powder diffraction (XRD), X-ray photoelectron Spectroscopy (XPS), propene chemisorption, EXAFS, and catalytic measurements of hydrogenation of carbon monoxide to long-chained hydrocarbons leading to clean fuels (Fischer-Tropsch Synthesis).

Cobalt nitrate decomposition leads to Co<sub>3</sub>O<sub>4</sub> nanoparticles. The Fischer-Tropsch reaction rate passes through the maximum as a function of calcination temperature. The results of XPS show the presence of incompletely decomposed cobalt nitrate for catalysts calcined at 90–200 °C, and the presence of Co<sub>3</sub>O<sub>4</sub> for catalysts calcined at 200–500 °C. For the four alumina-supported nano-cobalt catalysts with different thermal treatment (200–500 °C), XRD and XPS results illustrated that there were mainly nano Co<sub>3</sub>O<sub>4</sub> crystalite phases of 9–10 nm and the size of cobalt nano-particles did almost not change with the different temperature of thermal treatment. This was different from that of silica-supported cobalt catalysts. The supported cobalt catalyst (CoAp340 sample) calcinated at 340 °C presented a better activity for Fischer Tropsch synthesis to clean fuels, at mild conditions like atmospheric pressure (1 bar), 1800 ml/g/h and 190 °C; rather than high pressure (20 bars or more). In the second system, the promotion effects of trace platinum were investigated. In the third system, the plasma enhancements were illustrated.

**About the Speaker.** Dr. Wei Chu is a Professor of Chemistry and Chemical Engineering in Sichuan University, China. He is also a New Century Excellent Talent of the Ministry of Education of China. Dr. Chu graduated from Nanjing University in 1984, obtained his PhD in 1991 in France (ULP, Strasbourg); and then carried out postdoctoral studies in State Key Laboratory of Catalysis in Dalian. He was promoted to Research Professor in 1995 in Chengdu Inst. of Org. Chem and was a Full Professor in Sichuan University since 2001. Dr. Chu collaborated with Scientists from a number of reputed institutions around the world since 1998. He has published more than 150 articles in journals and proceedings and has 7 Chinese Patents. He is the Editor of a book “Catalyst Engineering” in Chinese. His scientific contributions have been awarded numerous prizes including the 2004 Prize of Advances in Sciences and Technologies of Sichuan Provinces in China.