TITLE	IMPROVED IRON CATALYSTS FOR SLURRY PHASE FISCHER-TROPSCH SYNTHESIS

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ABSTRACT

OBJECTIVES

Texas A&M University (TAMU) will work together with Hampton University to develop improved attrition resistant iron catalysts for converting coal-derived synthesis gas to high quality diesel fuels. The catalysts will be designed for slurry phase Fischer-Tropsch synthesis (FTS), which is recognized as the preferred mode of operation for Fischer-Tropsch synthesis reactors. Slurry phase catalysts based on iron tend to break down into fine particles leading to severe operational difficulties in separating the hydrocarbon products from the catalyst. The primary objective of this research program is to improve attrition resistance of iron catalysts developed at TAMU, which have high activity and selectivity to high molecular weight hydrocarbons (high alpha catalysts). The synthesis of catalyst precursors, measurement of attrition properties and testing in fixed bed and slurry reactors of spray dried catalysts will be performed at TAMU. Hampton University will prepare final catalysts in a bench scale spray drier unit, and provide expertise in selection of binders and their properties required to produce catalysts of high attrition strength. Attrition behavior will be studied in a stirred tank reactor and/or a small slurry bubble column reactor by following particle size distribution as a function of time. This will provide a direct measure of changes in particle size distribution in slurry reactors after activation and/or during synthesis, and accounts for both physical and chemical effects. The attrition resistance and the catalyst performance during FTS will be determined simultaneously under conditions representative of industrial practice.

ACCOMPLISHMENTS TO DATE

Previous work has demonstrated that the TAMU's baseline catalysts (100 Fe/3 Cu/4 K/16 SiO_2 and 100 Fe/5 Cu/6 K/24 SiO_2) provide high activity and a suitable product distribution for conversion of coal-derived syngas to hydrocarbon liquids. However, there is a concern that this type of catalyst is structurally weak and easily breaks up into smaller particles. The attrition properties of TAMU's catalyst 100 Fe/3 Cu/4 K/16 SiO_2 have been examined during the current collaborative research project between University of New Mexico (UNM), Bringham Young University (BYU) and TAMU funded by DOE's UCR program (Grant DE-FG26-98FT40110). It was found that the attrition resistance of this catalyst, as measured by ultrasonic irradiation method, is better than that of commercial alumina and silica supports, and of a spray dried Fe/Cu catalyst prepared by UNM. Very little generation of fine particles below 5 μm, due to erosion, occurred after 25 minutes of ultrasonic irradiation. The SEM image showed that as-prepared catalyst is irregularly shaped. It is expected that spray drying, which produces spherical particles, will further improve the attrition strength of this catalyst. .

PLANS FOR THE COMING YEAR

- Synthesis of spray dried catalysts at TAMU and Hampton University;
- Testing of catalysts synthesized at TAMU and Hampton University in stirred tank slurry reactors;
- Attrition testing under reactive and non-reactive conditions in slurry reactors.

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ARTICLES, PRESENTATIONS AND STUDENT SUPPORT

Conference Presentations

Dragomir B. Bukur, Ketil F. Hanssen and Chokkaram Sivaraj, "Supported Iron Catalysts for Fischer-Tropsch Synthesis", paper presented at the AICHE Spring National meeting, April 2001, Houston, Texas.

Students Supported under this grant

At the present time there are no graduate students supported by this grant. Dr. Anil Kinage is expected to start working on this project as of April 1, 2001.