ALTERNATIVE FUELS AND CHEMICALS FROM SYNTHESIS GAS

FINAL

Technical Progress Report No. 22

For the Period 1 January - 31 March 2000

Contractor

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Prepared for the United States Department of Energy
Under Contract No. DE-FC22-95PC93052
Contract Period 29 December 1994 – 31 July 2002

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Contract Objectives

The overall objectives of this program are to investigate potential technologies for the conversion of synthesis gas to oxygenated and hydrocarbon fuels and industrial chemicals, and to demonstrate the most promising technologies at DOE's LaPorte, Texas, Slurry Phase Alternative Fuels Development Unit (AFDU). The program will involve a continuation of the work performed under the Alternative Fuels from Coal-Derived Synthesis Gas Program and will draw upon information and technologies generated in parallel current and future DOE-funded contracts.

RESULTS AND DISCUSSION

TASK 1: ENGINEERING AND MODIFICATIONS - no activity this quarter

TASK 2: AFDU SHAKEDOWN, OPERATIONS, DEACTIVATION AND DISPOSAL - no activity this quarter

TASK 3: RESEARCH AND DEVELOPMENT

LaPorte LPDME™ Demonstration

- Elemental analysis of spent catalyst samples from the 1999 LaPorte LPDME^{TM} trial was performed. No accumulation of poisons was detected.

LPDME™ Research and Development

- Catalyst stability under a condition involving water injection was tested. The aging rate was slightly greater than the baseline, but agreed with our current understanding of the pattern of catalyst deactivation.

- Efforts were made to find the deactivation pattern of a type of bifunctional DME catalysts. No definitive observations could be made due to poor reproducibility.

- A new experiment using a Robinson-Mahoney basket and pelletized catalysts was conducted under a set of conditions different from the previous two experiments using the R-M basket.

Rapid catalyst deactivation was observed. This showed that catalyst deactivation is not slurry specific; it can occur even when pelletized catalysts are used. Further experiments will be performed to determine if the presence of the oil plays any role in catalyst deactivation.

- A paper entitled "Qualitative Analysis of the Syngas-to-DME Reaction System" has been prepared for the 3rd Joint China/U.S. Chemical Engineering Conference, to be held 25-28 September in Beijing. It presents our most current kinetic understanding of the LPDME™ reaction system, its features and underlying mechanisms.

Hydrodynamics Catalyst Slurribility

- Oil intrusion experiments showed that the Drakeol 10 oil is non-wetting to the fresh alternate methanol synthesis catalyst at ambient conditions. In other words, as expected, the alternate methanol synthesis catalyst is a hydrophilic material. However, oil can enter the pores of the catalyst with slight pressurization. By 20 psig, almost 90% of the pores are filled with oil. Furthermore, this intrusion is highly irreversible. Would this irreversible pore-filling make the catalyst behave like a hydrophobic material? What effects does it have on the colloidal behavior of the catalyst under LP conditions? These will be the questions for further investigation.

- Experiments showed that our current catalyst settling experiments are subject to poor reproducibility and uncertainty in explaining the results. These issues need to be addressed before this method becomes useful for slurribility studies.

TASK 5: PROJECT MANAGEMENT

Liquid Phase DME Demonstration at the LaPorte AFDU

Results of the 1999 DME run were presented to DOE personnel on 4 February. Report writing has begun on a part-time basis, with a goal to complete a draft of the topical report by the end of May. An abstract for the paper entitled "Catalyst and Process Development for Liquid Phase DME Synthesis" was submitted. This paper will be presented at the 17th Annual International Pittsburgh Coal Conference (11-15 September 2000).