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DOE/PC/89787--1

DE91 006624

**NOVEL REACTOR CONFIGURATION FOR SYNTHESIS GAS
CONVERSION TO ALCOHOLS**

DE-FG22-89PC89787

QUARTERLY REPORT

October 1, 1989 - December 31, 1989

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I. Objectives for the First Quarter, Year 1:

The project started on October 1, 1989 and according to the Task Schedule provided in the original work breakdown schedule, Task I was to be completed in the first quarter and Task II to be started. Task I consisted of construction of the slurry reactor set-up to be used in Task IV for determination of the reactor kinetics and procurement of the parts for automation equipment, separators, computer activated parts etc. for automation of the trickle bed reactor and GC equipment. Task II consisted of standardization and automation of GC analysis protocols.

II. Accomplishments, First Quarter, Year 1:

We constructed the slurry phase CSTR reactor, shown in Figure 1, for determination of the kinetics of methanol synthesis reaction on the catalyst to be used in the trickle bed reactor. The reactor contains an inert liquid mineral oil, Witco Freezene 100, in which the catalyst will be suspended. The mineral oil can be in the batch mode or it can be circulated. For the kinetics studies it is preferred that the inert liquid and the catalyst be in the batch mode and maintained in the reactor. In the batch mode of operation, the reactant gases would be metered and fed to the reactor and the product stream, also in the gas phase, leaves the reactor continuously with on line analysis of the products. The system is designed for on line analysis of the effluent in the gas phase and analysis of condensables off line. A porous metal filter is used on the effluent line to keep the catalyst in the reactor.

We are planning to use on line and off line GC's both for

the CSTR and the trickle bed reactor assemblies. The on line GC uses a Porapak packed column and will be used for analysis of the gas phase products. The off line GC uses a fused silica capillary column for analysis of the mineral oil for dissolved alcohols and for any degradation products. The standardization of GC analysis protocols is also started during this quarter and most of the effort was spent on deciding the right columns in each GC.

III. Modification of Tasks and Objectives:

Although not proposed in the original project, we have decided to determine the hydrodynamic and transport parameters of our trickle bed reactor in order to isolate and study just the reaction parameters during methanol and higher alcohol synthesis Tasks of the project. This modifies Task III to include determination of reactor parameters. We have decided to delay procurement of parts for the automation of this reactor until we figure out how we will determine the necessary parameters in the reactor setup we have within the budget restrictions.

IV. Problems Encountered:

Our initial plans were to purchase CO/CO₂ mixture and H₂ in large size cylinders. Since the reactors will operate at 750-1000 psia pressure, the cylinders can only be used until that pressure. We do have a small laboratory size compressor and were planning to combine together the contents of cylinders that has been consumed to a pressure of 1000 psia in order to reduce costs associated with returning cylinders that still contain significant amounts of nonconsumed gases. The University regulations concern-

ing safety in laboratories became more stringent and now limits the size of cylinders of toxic and/or explosive gases that can be in the laboratories. Therefore logistics of gas supply can be a problem in the future. In addition, the department initiated a safety review for each project, which may delay onset of experiments a few months.

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03 / 04 / 91