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# Engineering Development of Slurry Bubble Column Reactor (SSBCR) Technology

Quarterly Report

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267

undertaken. Interfacial tension of  $N_2$ /Paratherm NF was measured for pressures ranging from atmospheric to  $> 3000$  psig and temperatures of 27 and 56.5°C. Surface tension in the organic system shows the same decreasing trend with increasing pressure as do water/nitrogen systems.

(The Ohio State University)

- The study of two-dimensional flow sometimes simplifies flow problems and leads to a more rapid understanding of the actual 3-D case. Thus, 2-D bubble columns were studied under a variety of flow rates using Particle Image Velocimetry (PIV). The PIV results revealed complicated flow structures that depend on gas velocity. A homogeneous flow regime, a regime containing four regions of flow, and a regime containing three regions of flow were seen as the velocity increased.

(The Ohio State University)

#### *Model Development*

- A new phenomenological model for liquid flow has been proposed. The Recycle-Crossmixing with Dispersion Model (RCFDM) augments the standard axial dispersion model (ADM) to allow for mixing at the top and bottom of the column and upflow and downflow regions in the column. The ADM alone cannot account for the tracer results seen at LaPorte and in the laboratory. The RCFDM structure is such that it can account for the tracer results. The RCFDM fits the tracer patterns measured in the laboratory using independent CARPT measurements to fit parameters.

(Washington University in St. Louis)

- Work on finding suitable closures for the Navier-Stokes equations for two- and three-phase flow continued. The major problem is finding suitable expressions for the interfacial momentum exchange terms. Qualitative agreement for two-dimensional bubble columns is demonstrated using only a few terms--drag, virtual mass and mixing length for the Reynolds stresses.

(Washington University in St. Louis)

#### *Data Processing*

- Radioactive tracer data from the hydrodynamics trial were received. Qualitative analysis of the data revealed that the pre-trial planning was adequate, and good profiles have been obtained. The data have been transmitted to Washington University for analysis.

(Air Products and Chemicals)