Books & Reports

Numerical Study of Pyrolysis of Biomass in Fluidized Beds

A report presents a numerical-simulation study of pyrolysis of biomass in fluidized-bed reactors, performed by use of the mathematical model described in "Model of Fluidized Bed Containing Reacting Solids and Gases" (NPO-30163), which appears elsewhere in this issue of *NASA Tech Briefs*. The purpose of the study was to investigate the effect of various operating conditions on the efficiency of production of condensable tar from biomass. The numerical results indicate that for a fixed particle size, the fluidizing-gas temperature is the foremost parameter that affects the tar yield. For the range of fluidizing-gas temperatures investigated, and under the assumption that the pyrolysis rate exceeds the feed rate, the optimum steady-state tar collection was found to occur at 750 K. In cases in which the assumption was not valid, the optimum temperature for tar collection was found to be only slightly higher. Scaling up of the reactor was found to exert a small negative effect on tar collection at the optimal operating temperature. It is also found that slightly better scaling is obtained by use of shallower fluidized beds with greater fluidization velocities.

This work was done by Josette Bellan and Danny Lathouwers of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30164

Assessment of Models of Chemically Reacting Granular Flows

A report presents an assessment of a general mathematical model of dense, chemically reacting granular flows like those in fluidized beds used to pyrolize biomass. The model incorporates submodels that have been described in several *NASA Tech Briefs* articles, including "Generalized Mathematical Model of Pyrolysis of Biomass" (NPO-20068) *NASA Tech Briefs*, Vol. 22, No. 2 (February 1998), page 60; "Model of Pyrolysis of Biomass in a Fluidized-Bed Reactor" (NPO-20708), *NASA Tech Briefs*, Vol. 25, No. 6 (June 2001), page 59; and "Model of Fluidized Bed Containing Reacting Solids and Gases" (NPO-30163), which appears elsewhere in this issue. The model was used to perform computational simulations in a test case of pyrolysis in a reactor containing sand and biomass (i.e., plant material) particles through which passes a flow of hot nitrogen. The boundary conditions and other parameters were selected for the test case to enable assessment of the validity of some assumptions incorporated into submodels of granular stresses, granular thermal conductivity, and heating of particles. The results of the simulation are interpreted as partly affirming the assumptions in some respects and indicating the need for refinements of the assumptions and the affected submodels in other respects.

This work was done by Josette Bellan and Danny Lathouwers of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
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