Books & Reports

Turbulence in Supercritical O_2/H_2 and C_7H_{16}/N_2 Mixing Layers

This report presents a study of numerical simulations of mixing layers developing between opposing flows of paired fluids under supercritical conditions, the purpose of the study being to elucidate chemical-species-specific aspects of turbulence. The simulations were performed for two different fluid pairs — O_2/H_2 and C_7H_{16}/N_2 — at similar reduced initial pressures (reduced pressure is defined as pressure ÷ critical pressure). Thermodynamically, O_2/H_2 behaves more nearly like an ideal mixture and has greater solubility, relative to C_7H_{16}/N_2, which departs strongly from ideality. Because of a specified smaller initial density stratification, the C_7H_{16}/N_2 layers exhibited greater levels of growth, global molecular mixing, and turbulence. However, smaller density gradients at the transitional state for the O_2/H_2 system were interpreted as indicating that locally, this system exhibits enhanced mixing as a consequence of its greater solubility and closer approach to ideality. These thermodynamic features were shown to affect entropy dissipation, which was found to be larger for O_2/H_2 and concentrated in high-density-gradient-magnitude regions that are distortions of the initial density-stratification boundary. In C_7H_{16}/N_2, the regions of largest dissipation were found to lie in high-density-gradient-magnitude regions that result from mixing of the two fluids.

This work was done by Josette Bellan, Kenneth Harstad, and Nora Okong'o of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

NPO-30561

Time-Resolved Measurements in Optoelectronic Microbioanalysis

A report presents discussion of time-resolved measurements in optoelectronic microbioanalysis. Proposed microbioanalytical "laboratory-on-a-chip" devices for detection of microbes and toxic chemicals would include optoelectronic sensors and associated electronic circuits that would look for fluorescence or phosphorescence signatures of multiple hazardous biomolecules in order to detect which ones were present in a given situation. The emphasis in the instant report is on gating an active-pixel sensor in the time domain, instead of filtering light in the wavelength domain, to prevent the sensor from responding to a laser pulse used to excite fluorescence or phosphorescence while enabling the sensor to respond to the decaying fluorescence or phosphorescence signal that follows the laser pulse. The active-pixel sensor would be turned on after the laser pulse and would be used to either integrate the fluorescence or phosphorescence signal over several lifetimes and many excitation pulses or else take time-resolved measurements of the fluorescence or phosphorescence. The report also discusses issues of multiplexing and of using time-resolved measurements of fluorophores with known different fluorescence lifetimes to distinguish among them.

This work was done by Gregory Bearman and Dmitri Kossakovski of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to

Intellectual Property group
JPL
Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109
(818) 354-2240

Refer to NPO-21046, volume and number of this NASA Tech Briefs *issue, and the page number.*