combustion between the burning surface and the primary water injection. Metal content in fuels was more than 70%. Parameters changing with the burning surface moving back have been analyzed and rules of surface temperature and burning rate have also been obtained. Results show that the mass flow rate and combustor pressure decreased as the burning surface moving back. Both distributions of the burning surface temperature and burning rate changing from "double hump" to "single hump" with the peak value decreasing. It was also found that steam concentration and gas temperature near the burning surface become lower with its moving back, the combustion zone keeps away from the surface, and the heat feedback decreases. Methods to drive the solid fuel or to increase injection positions were presented in order to reduce the effect.

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14:01–Function Hall B

Lifted flames of n-heptane in coflow jets with initial temperature variation

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The characteristics of laminar lifted flames of n-heptane diluted with nitrogen have been investigated by varying the initial temperature in coflow jets. The result showed that the lifted flame in the non-autoignited regime has a tribrachial structure similar to the cases of gaseous fuels, and the liftoff heights are correlated reasonably with fuel jet velocity scaled by the laminar burning velocity. For the coflow temperature above 900 K, autoignited flames are formed that did not require any external ignition source. For smaller fuel mole fraction, mild combustion is observed. The liftoff heights of autoignited lifted flames could also be correlated with fuel jet velocity scaled by laminar burning velocity. While the correlation with the adiabatic ignition delay time is weak, which implied the insensitivity of the delay time with temperature variation in this temperature range.

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14:04–Function Hall B

Studies on the laminar flame speed of binary fuel blends

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Binary fuel blends are widely utilized in internal combustion engines as well as in the development of surrogate fuel models. Due to the strong nonlinearity of the chemical reaction process, the laminar flame speed of binary fuel blends can not be obtained from the linear combination of the laminar flame speed of the individual fuel constituent. In this study, theoretical analysis is conducted for a planar premixed flame of binary fuel blends and a model for the laminar flame speed of binary fuel blends is developed. This model can predict the laminar flame speed of binary fuel blends when three laminar flame speeds are available: two for each individual fuel component and the third one for the fuel blends at one blending ratio. The performance of this model is assessed for different types of binary fuel blends. Good agreements with calculations or measurements are achieved by the model prediction.

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14:07–Function Hall B

Front propagation in compressible flows

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We investigate the relevance of the compressibility for the front propagation in laminar flows. We study two classes of imposed model flows in which the compressibility is controlled parametrically: shear and cellular compressible flows. We focus on regimes at high Peclet and Damköhler number and we observe that in both shear and cellular flows the mean asymptotic front speed does not change very much at varying the intensity of the compressibility. On the contrary the instantaneous shape of the concentration field can be visibly altered.

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14:10–Function Hall B

A coupled heat transfer analysis with effects of thermal/catalytic cracking of kerosene for regenerative cooled supersonic combustor

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In this paper, a heat transfer analysis coupling the combustor flow, the coolant flow (on-board hydrocarbon fuel) and the cooling wall was introduced for the study of regenerative cooling of supersonic combustor. The combustor flow was determined by solving differential equations of mass,momentum and energy and with modeling of fuel/air mixing and combustion. The flow and heat transfer properties of the coolant were calculated with a 10-species surrogate and coupled with the heat conduction through the wall. Global reaction models for thermal and catalytic cracking were introduced and they were implemented in the present analysis. Results of the analysis showed that both thermal and catalytic cracking supply extra heat sinks for the cooling at a fuel temperature exceeding 750–800 K due to endothermicity of cracking. Compared to the cooling with thermal cracking, catalytic cracking gives better cooling effect since it provides significantly larger chemical heat sink.

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