Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Scalar mixing in LES/PDF of a high-Ka premixed turbulent jet flame[1] JIAPING YOU, YUE YANG, College of Engineering, Peking University — We report a large-eddy simulation (LES)/probability density function (PDF) study of a high-Ka premixed turbulent flame in the Lund University Piloted Jet (LUPJ) flame series, which has been investigated using direct numerical simulation (DNS) and experiments. The target flame, featuring broadened preheat and reaction zones, is categorized into the broken reaction zone regime. In the present study, three widely used mixing modes, namely the Interaction by Exchange with the Mean (IEM), Modified Curl (MC), and Euclidean Minimum Spanning Tree (EMST) models are applied to assess their performance through detailed *a posteriori* comparisons with DNS. A dynamic model for the time scale of scalar mixing is formulated to describe the turbulent mixing of scalars at small scales. Better quantitative agreement for the mean temperature and mean mass fractions of major and minor species are obtained with the MC and EMST models than with the IEM model. The multi-scalar mixing in composition space with the three models are analyzed to assess the modeling of the conditional molecular diffusion term. In addition, we demonstrate that the product of OH and CH_2O concentrations can be a good surrogate of the local heat release rate in this flame.

[1]This work is supported by the National Natural Science Foundation of China (Grant Nos. 11521091 and 91541204)

Jiaping You
College of Engineering, Peking University

Date submitted: 25 Jul 2016 Electronic form version 1.4