Characterization of Turbulent Combustion Processes in Dimethyl Ether Flames Using Advanced Laser Diagnostics

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Dimethyl ether (DME; CH_3OCH_3) is a promising oxygenated fuel that has the potential to be widely used as an alternative to natural gas for power production and/or as a substitute for diesel fuel in compression-ignition (CI) engines. However, little is known about its fundamental combustion processes, especially under highly turbulent conditions such as those found in engine environments. We are using advanced laser diagnostics to "probe" the fundamental physio-chemical processes occurring in DME-fueled turbulent flames through non-intrusive temperature and species concentration measurements. Laser diagnostics provide excellent spatial and temporal resolution, which is paramount for directly investigating the competition between the turbulent fluid mechanics, transport processes, and finite-rate flame chemistry. One example of laser-based imaging of the hydroxyl (OH) radical in a turbulent DME flame is shown below. Here we highlight the difference between the OH field using a conventional CH_4 fuel (DLR) vs. DME fuel