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Formation of soot spike in n-dodecane spray combustion MIN ZHANG, JIUN CAI ONG, Technical University of Denmark, KAR MUN PANG, MAN Energy Solutions, XUE-SONG BAI, Lund University, JENS HONORE WALTHER, Technical University of Denmark — Numerical simulations are conducted to identify the underlying mechanism that governs the early soot evolution process in n-dodecane spray flames at 21 % O2 level. The early evolution of soot mass, in particularly the soot spike phenomenon, is captured in the present large eddy simulation (LES) case, but not in the Unsteady Reynolds Averaged Navier-Stokes (URANS) case. Hence, a comparison of simulation results from LES and URANS is conducted to provide a better insight of this phenomenon. LES is shown to predict a rapid increasing in soot mass during the early stage of soot formation due to having a large favorable region for soot formation (equivalence ratio > 1.5 and local temperature $> 1800\,\mathrm{K}$). This favorable region increases and then decreases to reach a quasi-steady state in LES, while it continues to increase in URANS during the early time. In addition, the formation rate does not increase continuously as soot precursor reaches a plateau, whereas oxidation rate continues to increase significantly in LES due to the ever increasing oxidizing species. This leads to a relatively dominant soot oxidation process over the soot formation process, which consequently results in the formation of soot spike in the LES case.

Zhang Min
Technical University of Denmark

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