Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Direct Numerical Simulation of Turbulent Hydrogen-Air Premixed Flames at Preheated and Diluted Donditions[1] WONSIK SONG, FRANCISCO E. HERNANDEZ PEREZ, King Abdullah University of Science and Technology (KAUST), EFSTATHIOS-AL. TINGAS, Perth College, University of the Highlands and Islands (UHI), HONG IM, King Abdullah University of Science and Technology (KAUST), KAUST TEAM — Moderate or intense low-oxygen dilution (MILD) combustion is a promising concept to achieve high-performance and low-emission combustion simultaneously. In this study, we investigate the front propagation and burning characteristics in the MILD mode through high-fidelity direct numerical simulation (DNS). As a baseline condition, a lean hydrogen-oxygen mixture at an equivalence ratio of 0.7 is considered, which is diluted with nitrogen and preheated. The turbulence parameters such as the integral length scale and RMS velocity are set to ten and five times larger than the laminar flame thickness and flame speed ($l_{\mathrm{T}/\mathrm{l_f}} = 10$, $u/S_{\mathrm{L}=5.2}$), respectively, such that the turbulence condition falls under the thin reaction zone in the so-called Borghi diagram of premixed combustion. Fundamental turbulent combustion characteristics including burning rate, flame structure and topology are examined, together with intrinsic hydrodynamic and diffusive-thermal instabilities.

[1]Research reported in this publication was supported by the King Abdullah University of Science and Technology (KAUST).

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Date submitted: 01 Aug 2019 Electronic form version 1.4