Similarity and Scaling of Turbulent Flame Speeds for Expanding Premixed Flames of C₄-C₈-n-alkanes¹ FUJIA WU, ABHISHEK SAHA, SWEETAPROVO CHAUDHURI, SHENG YANG, CHUNG K. LAW, Princeton University — We experimentally investigated the propagation speed of constant-pressure expanding flames in near isotropic turbulence using a dual-chamber, fan-stirred vessel. The motivation is to test whether the fuel similarity concept among C₄-C₈ n-alkanes on laminar flames also holds for turbulent flames. Previously it was found that the laminar flame speed and Markstein length are almost identical for C₄-C₈ n-alkanes. If this fuel similarity concept can also be shown for turbulent flames, it will suggest a canonical flame structure for large hydrocarbon fuels, i.e., large fuels always decompose to small C₀-C₄ fuel fragments before being oxidized, and would significantly simplify the description of the flames. Preliminary results show that in the flamelet and thin-reaction zone, turbulent flame speeds of C₄-C₈ n-alkanes are indeed largely similar at various conditions, thereby suggesting the fuel similarity for turbulent flames. In addition, it is found that the normalized turbulent flame speed also approximately scales with the square root of an appropriately-defined Reynolds number recently found for C₀-C₄ fuels.

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