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Lewis number effects on extinction of premixed flames under oscillating strain rates. ADITYA POTNIS, VISHNU R. UNNI, Department of Mechanical and Aerospace Engineering, University of California San Diego, San Diego, CHUNG K. LAW, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, ABHISHEK SAHA, Department of Mechanical and Aerospace Engineering, University of California San Diego, San Diego — Flame extinction due to transient and oscillating flow strain is common in combustion devices, such as IC engines and gas turbines. To evaluate the role of differential diffusion on such extinction, we present an experimental study of a counterflow premixed twin-flame under oscillating strain with varied Lewis numbers (Le), defined as the ratio of the thermal diffusivity of the mixture to the mass diffusivity of the deficient species. By using methane and propane as fuels, the measured instantaneous strain rates required for extinction at various oscillation frequencies and mean strain rates were recorded and compared for both rich and lean mixtures. At low mean strain rates, the extinction was found to be controlled by flow reversal at nozzle. However, for relatively large mean strain rates, normal extinction was achieved for all flames considered. The maximum strain rate for Le >1, was found to be greater than the steady state extinction strain rate. While for Le <1 flames, the maximum strain rate at extinction was found to be insensitive to oscillations and approximately equal to the steady state extinction strain rate. This distinctively different behavior depending on the non-unity nature of the Lewis number is analyzed using a time-scale analysis.

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