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Turbulent Flame Speed and Self Similarity of Expanding Premixed Flames SWETAPROVO CHAUDHURI, FUJIA WU, DELIN ZHU, CHUNG LAW, Princeton University — In this study we present experimental turbulent flame speed data measured in constant-pressure expanding turbulent flames, propagating in nearly homogenous isotropic turbulence, in a dual-chamber, fan-stirred vessel. The cold flow is characterized by high speed particle image velocimetry while the flame propagation rate is obtained by tracking high speed Schlieren images of unity Lewis number methane-air flames over wide ranges of pressure and turbulence intensity. It is found that the normalized turbulent flame speed as a function of the average radius scales as a turbulent Reynolds number to the one-half power, where the average radius is the length scale and thermal diffusivity is the transport property, thus showing self-similar propagation. Utilizing this dependence it is found that the turbulent flame speeds from expanding flames and those from Bunsen geometries can be scaled by a single parameter: the turbulent Reynolds number utilizing recent theoretical results obtained by spectral closure of the G equation, after correcting for gas expansion effects.

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