

Abstract Submitted
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Effects of nucleating species on soot formation in turbulent non-premixed sooting jet flames ABHISHEK JAIN¹, YUAN XUAN², Pennsylvania State Univ — Soot nucleation is one of the most unknown processes in the soot life cycle, and it is believed to occur from Polycyclic Aromatic Hydrocarbons (PAH) generated from the combustion of various fuel sources under locally fuel-rich conditions. Current soot nucleation models may include as few as one (typically naphthalene) or as many as a dozen of nucleating species. In this study, the effects of PAH inclusion in the soot nucleation model on soot yield and distribution are studied by means of Large-Eddy Simulations (LES) of two piloted turbulent non-premixed sooting jet flames, using ethylene and a jet fuel surrogate, respectively. Two sets of simulations are performed for each flame, one considering only a single nucleating PAH (naphthalene) and the other one considering a range of nucleating PAH from naphthalene to cyclopenta[cd]pyrene. Flamelet-based chemistry tabulation is used for the major thermochemical quantities, and a recently developed relaxation model is used for PAH species to account for the interactions between turbulence and their chemistry. The effects of nucleating PAH species on soot are highlighted by comparing the mean soot volume fraction distributions and statistical characteristics of soot obtained from both sets of simulations against experimental measurements.

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