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Effects of Hydrogen Enrichment on Methane and Natural Gas Premixed Laminar Flames under SI-Engine Conditions[1] SAKET PRIYADARSHI, DANIEL HAWORTH, The Pennsylvania State University — Hydrogen and hydrogen/hydrocarbon blends are being explored as alternatives to hydrocarbon fuels in reciprocating-piston IC engines. Here CHEMKIN, PREMIX, and XSENKPLOT have been employed to explore global properties and local structure of steady one- dimensional laminar premixed flames of methane and natural gas with varying levels of hydrogen enrichment under typical spark- ignition engine conditions. The ratio of hydrogen to methane or natural gas has been varied while holding the total energy of the reactants fixed. Simulations have been performed for equivalence ratios from the lean flammability limit to stoichiometric, and results from four chemical mechanisms have been compared. Effects of hydrogen enrichment on laminar flame speed, internal flame structure, reaction pathways, and NOx levels have been studied. It has been found that OH appears earlier in the flame and at higher concentrations with hydrogen in the reactants, confirming a flame-speed enhancement mechanism that had been proposed in the literature. The relative importance of molecular transport compared to chemical kinetics has been examined by varying the molecular transport model; for these steady one-dimensional laminar flames, the role of differential diffusion is minor.

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