Laminar burning velocity of lean H_2 + air mixtures and its temperature dependence obtained from flat flames

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Lean H_2 + air flames have been a focus of many studies, yet measurements of the laminar burning velocity (S_L) possess a dramatic spread that hampers validation of kinetic models. This data scattering is due to the difficulties associated with experimental determination of S_L from stretched flames [1,2]. In the present work, burning velocity of lean H_2 + air flames and its temperature dependence were for the first time determined in flat flames by using the heat flux method. Equivalence ratio was varied in the range of ϕ = 0.4-0.5, and unburned gas temperature T_0 = 278-338 K. The results are shown in Figure 1, the temperature dependence presented in the right hand side panel is expressed in the form of temperature exponent α in the power law $S_L=S_{L0}(T/T_0)^{\alpha}$. During the measurements, the shape of the flames was monitored by imaging the OH* emission using an EM-CCD camera sensitive at λ=310nm and a bandpass filter. In most cases, except for lower ϕ at 278 K, the flames became corrugated at adiabatic conditions, therefore the laminar burning velocity was extrapolated from sub-adiabatic flames. The influence of extrapolation on S_L and α was quantified and discussed together with other experimental uncertainties (See Figure 1).

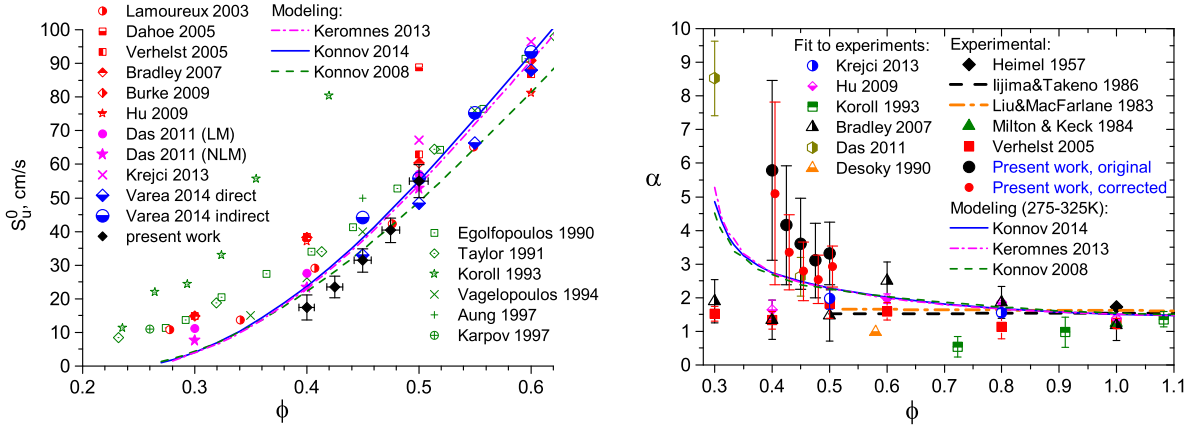

Figure 1. S_L (left) and power exponent α (right) of H_2+air flames measured in the present study, available from the literature, and modeled with three recent kinetic schemes.

[1] F. Wu, W. Liang, Z. Chen, Y. Ju, C.K. Law, Proc. Combust. Inst. (2014); http://dx.doi.org/10.1016/j.proci.2014.05.065.
[2] E. Varea, J. Beeckmann, H. Pitsch, Z. Chen, B. Renou, Proc. Combust. Inst. (2014); http://dx.doi.org/10.1016/j.proci.2014.05.137.