Data consistency of the burning velocity measurements

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Consistent datasets of experiments are highly important both for validation and optimization of kinetic mechanisms. Analysis of the data consistency of all available burning velocity measurements of hydrogen flames using the heat flux method at atmospheric pressure is performed in the present work. A comparison of many experiments performed in several laboratories with different types of dilution by various inerts was guided by kinetic modeling using two kinetic mechanisms. The Konnov (*Combust. Flame,* 162 (2015) 3753) and ELTE (*Int. J. Chem. Kinet*., 48 (2016) 407) models demonstrated uniform trend at all conditions tested: the second mechanism predicts lower burning velocities which are in better agreement with the heat flux measurements from different groups. Some experimental datasets, however, significantly disagree with one or both models; these conditions were revisited experimentally in the present work. The laminar burning velocity of $H_2 + O_2 + N_2$ mixtures with 7.7% O_2 in $O_2 + N_2$ oxidizer and of 85:15 ($H_2 + N_2$) and 25:75 ($H_2 + N_2$) fuel mixtures with 12.5:87.5 (O_2 + He) oxidizer have been measured. It was concluded that results of Hermanns et al. (*Energy Fuels,* 21 (2007) 1977) are somewhat higher than those of other studies at similar conditions and possible reason of this disagreement was suggested. Analysis of the measurements performed by Goswami et al. (*Proc. Combust. Inst.,* 35 (2015) 655) on high-pressure installation suggests equipment malfunction that led to the erroneous values of equivalence ratio for hydrogen and syngas flames. The ELTE mechanism developed using optimization approach shows very good performance in predicting laminar burning velocities of hydrogen flames measured using the heat flux method.