Heat Flux Method: Past, Present and Future

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In the present energy scenario, a range of new gaseous and liquid alternative fuels are emerging that provide solutions to higher efficiency and lower emission. In order to judge the performance of such fuels research in the direction of evaluating the combustion properties are of utmost importance. An innovative experimental technique known as the "Heat flux method" is a useful tool in studying 1-dimensional flames of many gaseous and liquid fuels. The method stabilizes an adiabatic 1-D flat flame on a specially designed burner by balancing the heat lost from the flame with heat gain to the unburnt gas mixture. The stretch-less flames obtained through this method are especially useful in measuring laminar burning velocity. This method is in use for the last two decades at many research institutes and is recognized for its high accuracy and reliability. Due to successful development and applicability in a variety of operating conditions, the technique has many publications and citations to its credit. The results so far have been used extensively to validate/improve chemical kinetic mechanisms, but also to develop combustion systems and analyze flame characteristics, such as blow-off, flash-back, turbulent burning rates and other important flame phenomena. In the present work, a critical overview of the technique is presented, in terms of principle, operation and sources of error. A review of unique experiments performed in the past are also outlined. Additionally, a set of new results on C2 and C3 hydrocarbons for pressures up to 4 bar are presented (figure 1). And finally, in an attempt to improve the accuracy of the method, a new burner design is presented that includes many features that potentially makes the method even more accurate.

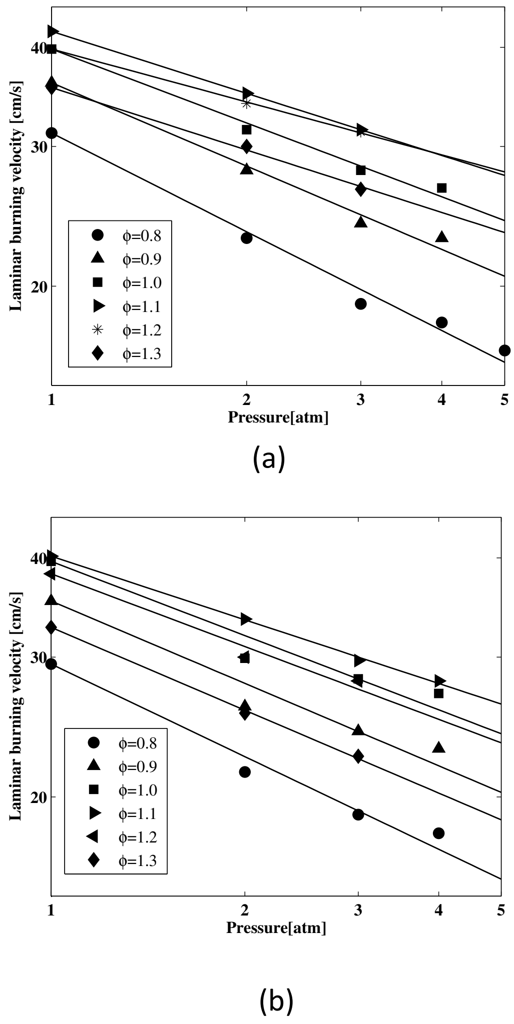

Figure 1: Pressure dependence of laminar burning velocity of (a) ethane-air and (b) propane-air mixtures at 298 K.