Effect of Inert Species on the Laminar Burning Velocity of Hydrogen and Ethylene

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Abstract

The maximum laminar burning velocity (LBV) of a fuel-air mixture is an important input parameter to vapor cloud explosion (VCE) blast load prediction methods. In particular, the LBV value has a significant impact on the predicted blast loads for high reactivity fuels with the propensity to undergo a deflagration-to-detonation transition (DDT). Published data are available for the maximum LBV of many pure fuel-air mixtures. However, little test data are available for mixtures of fuels, particularly for mixtures of fuels and inert species. Such mixtures are common in the petroleum refining and chemical processing industries. It is therefore of interest to be able to calculate the maximum LBV of a fuel/inert mixture based on the mixture composition and maximum LBV of each flammable component.

This paper presents measured test data for the maximum LBV of H2/inert and C2H4/inert mixtures, with both nitrogen and carbon dioxide as the inert species. The LBV values were determined using a constant-volume vessel and the pressure rise method. This paper also provides a comparison of the measured LBV values with simplified LBV prediction methods.