ABSTRACTS AND INFORMATIONS

I C D E R S

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LIMITING TUBE DIAMETER OF GASEOUS DETONATION

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Abstract

The currently used criterion of detonation limit in tubes is essentially based on experimental observations indicating transition of multi-front detonation structure to the spinning wave configuration near the limit. According to the Zeldovich theory the physical mechanism of the limit consists in increasing momentum and energy losses as the channel diameter decreases. In this paper an attempt is made to verify the empirical criterion within the framework of a modified 1-D theory of detonation limits.

Properly increased values of drag and heat transfer coefficients, as compared to the values in a steady stabilized flow, are used in the momentum and energy conservation equations, which constitutes the principal feature of the suggested model. Experimental values of the CJ detonation velocity and correlations for the ignition delay are also incorporated into the model.

For a wide variety of fuel-oxidizer mixtures the calculated limiting tube diameters correlate fairly well with the value calculated by the empirical criterion. Also stated is a good quantitative agreement between the calculated and measured dependence of the limiting tube diameter on mixture composition and initial pressure.

A comparison indicates that the empirical criterion based on a cell size of multi-head detonation is confirmed by the 1-D model of the limits. The calculation results are discussed with due regard for the structure of spinning detonations and the role of turbulence in the detonation propagation mechanism.