Estimation of the degree of folding for freely expanding flames

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The paper analyzes numerically the spatial structure of freely expanding flames in the reactive gas. Herewith, the particular case of pressurized hydrogen-oxygen mixture is considered where the transition to detonation is observed in the process of free flame expansion [1]. One of the leading roles in the flame acceleration and deflagration-to-detonation transition (DDT) belongs to the development of the spatial structure of the flame front. In particular, the birth and growth of short-wavelength perturbations defines the flame acceleration via a power law [2]. As a result of flame instability development the compression waves are irradiated by the flame, and their interaction with each other and the reaction zone leads to the detonation formation [3]. The particular mechanism of detonation onset is related to the spatial structure of the flame front and the way via which it is developed [4]. At the same time, the critical conditions of DDT are of certain demand, and it is interesting to estimate them for further usage. Among the parameters defining the degree of flame acceleration is the degree of flame folding which is conventionally used in simplified 1D models [5]. Here we analyzes 2D and 3D structure of the freely expanding flames to get quantitative information on the degree of folding, its changing in time and critical value correspondent to the DDT.

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