LARGE-SCALE DYNAMICS OF COMBUSTION KERNELS IN ULTRALEAN HYDROGEN–AIR MIXTURES IN TERRESTIAL GRAVITY CONDITIONS

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Abstract: The present paper discusses results of the experimental study on the combustion kernels dynamics in large-scale volumes filled with the ultralean hydrogen–air mixture in terrestrial gravity conditions. Main stages of the flame kernel evolution induced by convective motion are determined and basic physical mechanisms defining features of the ultralean combustion in the presence of natural convection are proposed. The results of the current research are compared with the data obtained numerically in the authors' previous paper. Performed comparison shows the general correctness of the numerical modeling and physical mechanisms revealed earlier on the basis of the numerical analysis. It is shown that convective motion plays crucial role in the process of flame propagation in ultralean combustible mixture. Upward rising velocity could be much greater than the burning velocity of the considered ultralean mixture. The analyzed processes may result in emergency situations and have to be taken into account while elaborating reliable fire and explosion safety measures.

Keywords: hydrogen safety; ultralean combustion; flame balls; large-scale flame

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