# Gravity impact on swirled flame stability

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It is known that the structure of non-reacting swirling jets substantially depends on the degree of flow swirling and the method of its imposition. With a sufficiently strong swirling in the mixing layer, spiral instability modes are enhanced, the vortex core decays, and a recirculation zone appears. In this case, the decay of the vortex occurs in various forms: spiral, bubble and (or) conic. In the case of reacting swirling flows, the effects of thermal expansion are superimposed on top of all the above-described effects. Accordingly, in practice, flow swirling is used as a method for the formation of large-scale vortex structures. Such structures provide for the existence of stagnant recirculation zones, which make it possible to increase the contact time of the reaction products with the fresh fuel–air mixture. During contact, the fuel–air mixture is heated, which facilitates its ignition, in turn, the precession of the vortex core significantly increases the intensity of heat and mass transfer. All this increases the stability of combustion, especially lean combustible mixtures. It is known that gravity through the forces of buoyancy makes a notable contribution to the dynamics and stabilization of the flame. In this case, the lower the flow rate, the more significant the influence, since there is competition between the buoyancy forces and the flow pulse. Earlier, it was shown that swirling flames take on different shapes under normal and reverse gravity. This work is devoted to the analysis of the stability of swirling methane–air flames depending on the direction of the action of gravitational forces. The shape of the swirling methane–air flame under the different fuel equivalence ratio conditions and gravity are studied.

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