M-flame under external acoustic field

Krikunova A I[@], Saveliev A S and Kossov G A

Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, Moscow Region 141701, Russia

[@] krikunovaai@gmail.com

The trend towards permissible reduction of NO_x emission standards requires the development and implementation of conceptually new technologies in the energy industry. Combustion technologies improvement methods can be divided into the following groups: lean mixtures combustion, catalytic combustion, and two-stage combustion (rich combustion—rapid mixing with an oxidizer—poor afterburning). Premixed lean combustion is the most commonly environmentally friendly technology used in the modern energy industry. However, such combustion less stable in comparison with diffusion one. Often, lean combustion systems operate under near-limit conditions. And, even insignificant fluctuations in the mixture composition, operating parameters, geometric configuration, and the method of introducing reagents can lead to a significant change in heat release and a possible resonant increase of the flame oscillation intensity. Typically, this resonant amplification is caused by the effects of acoustic vibrations present in most technical devices. In this case, the elements of the device that are not directly related to the functioning of the burner unit can also serve as the primary source of acoustic vibrations. Typical design solutions of burners and combustion chambers of engines are often subject to the formation of the above-described positive feedback, including due to the transmission of acoustic vibrations along the structure. Such flame instabilities, excited by acoustics, are referred to in technical devices as thermoacoustic ones. The current study is devoted to the stabilized premixed flame characteristics under the external acoustic field.

This work was supported by the Russian Science Foundation (grant No. 20-79-10328).