Study of the gas hydrate combustion initiation initial stage

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Gas hydrates are distributed throughout the world, have a high energy density and are an environmentally friendly energy source with great potential. Today, experimental and theoretical studies of gas hydrates are associated with four important areas: gas hydrate formation and dissociation [1], extraction and transportation technologies [2], and combustion behavior [3]. An important direction is related to the stability of the composition and structure of gas hydrates.

To study the characteristics of the combustion of gas hydrates, various methods of initiating the process are used. The purpose of this work was a theoretical study of the gas hydrate combustion initiation initial stage under convective heating conditions.

Under conditions of convective heating (at 973-1273 K), the gas hydrates ignition delay time decreases by 90-93% with a change in the heat transfer coefficient (α) in the ranges of 0–200 W/m^2·K (Fig. 1), which corresponds to the air flow velocity of up to 6 m/s. The minimum decrease in the ignition delay time, i.e., from 0.1001 s to 0.0255 s (by 75%), corresponds to a heating temperature of 1073 K. The maximum decrease is at a temperature of 1273 K, where by ignition delay time changes from 0.1001 s to 0.0083 s (by 92%), the value of α varies between 0 and 200 W/(m^2·K).

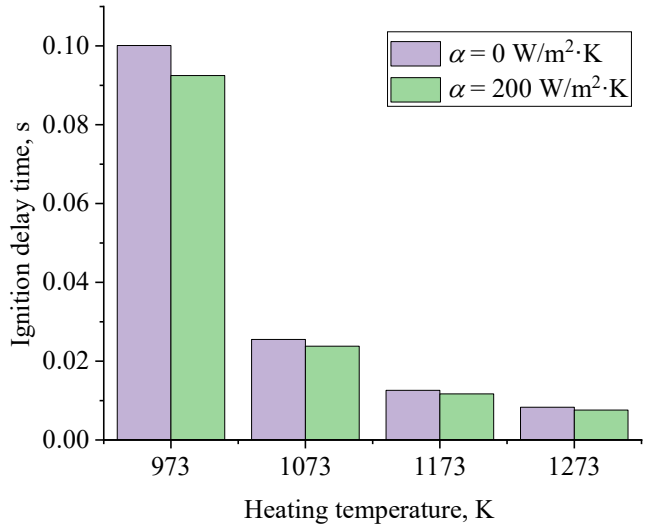

Figure 1 – Theoretical dependency ignition delay time on heating temperature under convective heating conditions.

In this paper, a model for initiating the combustion of gas hydrate during heating with the dominance of convective heat transfer has been developed. The dependence of the ignition delay time on the heating temperature by varying the heat transfer coefficient has been established.

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