FLAMELESS BURNING OF LARGE N-DODECANE DROPS IN MICROGRAVITY CONDITIONS

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Abstract: Forced ignition and combustion as well as self-ignition of a large (2–4 mm) n-dodecane droplet in air atmosphere at normal pressure under microgravity conditions are studied on the basis of the physicomathematical model of droplet combustion and the detailed kinetic mechanism of oxidation and combustion of n-dodecane $C_{12}H_{26}$. The choice of n-dodecane fuel is caused by the Russian-American space experiment "Zarevo" launched at the International Space Station in 2017. The results of investigation deepen our knowledge on the flameless combustion of droplets under microgravity conditions. Calculations show that after the radiation extinction of the "hot" flame, large droplets can continue evaporating due to the exothermic low-temperature oxidation of fuel vapor with multiple flashes of blue and hot flames at a characteristic temperature of 950 K. A detailed analysis of the calculation results shows that regular temperature flashes are caused by the thermal decomposition of hydrogen peroxide — reaction branching with the formation of hydroxyl radicals.

Keywords: droplet combustion; n-dodecane; microgravity; low-temperature oxidation; blue flame; calculation

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