KINETICS OF THE INTERACTION OF TRIETHYLALUMINUM DROPS WITH SUPERHEATED STEAM: EXPERIMENT, PHYSICOCHEMICAL MODEL, AND SCHEME OF CHEMICAL REACTIONS

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Abstract: Triethylaluminum Al $(C_2H_5)_3$ (TEA) is considered as a promising fuel for jet propulsion systems, napalms, and incendiary compounds: it and its solutions in hydrocarbon solvents spontaneously ignite upon contact with air and react violently with water. The paper presents the results of preliminary experiments on self-ignition and combustion of a jet of liquid starting fuel PG-2 containing 13% TEA and 87% triethylboron $B(C_2H_5)_3$ (TEB) in superheated steam. In the approximation of electrolytic interaction, a scheme of the main reactions of the interaction of TEA with water vapor is proposed. It is implied that the reaction of TEA with steam contains two main stages: at the first stage, active radical OAl(OH) and final product C_2H_6 are formed, whereas at the second stage, the other final product, Al_2O_3, is formed.

Keywords: triethylaluminum; steam; self-ignition; kinetics of reactions

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Figure Captions

Figure 1 Schematic of the experimental setup: *1* — argon cylinder; *2* — pressure reducer; *3* — comb; *4*— pressure gauge; *5* — pressure gauge in the tank; *6* — filling funnel; *7*— fuel tank (n-hexane); *8* — pyrophoric fuel tank (PG-2); *9* — gate with liquid PMS-5; *10* — low pressure reducer; *11* — rotameter; *12*— lantern; *13* — thermocouple; *14* — wet steam source; *15* — resistive heater; *16* — heater; *17* — source power supply; *18* — nozzle block; and *19* — nozzle

Figure 2 Photo of a TEA flame in superheated steam (top to bottom: steam, flame, heater, and injector)

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