PARTIAL FUEL CONVERSION AS A WAY TO INTENSIFY THE COMBUSTION PROCESS IN AN EJECTOR-BASED DUAL-CIRCUIT PULSEJET

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Abstract: In the 1960s, E. M. Glukharev developed an ejector pulsejet for the purpose of its application to rotate the helicopter propeller. The engine was further developed by the present authors. As a result, a two-circuit ejector pulsejet was constructed which is shown to be capable of operating in a mode close to cyclic detonation, or quasi-detonation in some cases, at subsonic and supersonic flight speeds. The article briefly describes the operation principle of the pulsejet and the mechanism of transition to a cyclic detonation mode. Also, one of the effective methods of boosting the pulsejet by implementing the partial conversion of fuel in the course of engine operation in the pulsed combustion mode.

Keywords: ejector pulsejet; cyclic detonation; quasi-detonation; detonation engine; gasoline pyrolysis; Glukharev engine; thermal conversion of fuel

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Figure Captions

Figure 1 Dual-circuit ejector pulsejet. Dimensions are in millimeters

Figure 2 Oscillogram of the pulsejet starting period taken by a microphone sensor near the exit of the resonator tube

Figure 3 Spectra of acoustic vibrations at the gas duct exit at $L = 1410$ (*a*) and $L = 1380$ mm (*b*): *1* — 100 Hz; *2* — 110; and *3* — 120 Hz

Figure 4 Thrust and fuel consumption vs. flight speed performance of the original pulsejet (*1*), the pulsejet with a cooled single-tube reactor (*2*), and the pulsejet with a single-tube reactor and three plates (*3*)

Figure 5 Photograph of the pulsejet running at a supercharging speed of 320 m/s

Figure 6 Oscillogram with the high-frequency combustion burst: *1* — signal of the pressure sensor in the combustor; and *2* — signal of the piezoquartz detonation sensor

Figure 7 Schematic of acetylene reactor and its installation in the engine. Dimensions are in millimeters

Figure 8 Schematic of plate installation in the second mixer. Dimensions are in millimeters

Figure 9 Approximate comparison of the calculated specific fuel consumption of the pulsejet [10] (*1*) and the ejector pulsejet equipped (*2*) and not equipped (*3*) with the fuel conversion reactor

Figure 10 Comparison of different types of jet engines by the fuel-based specific impulse [11]: *1* — ramjets; *2* — pulsejets (Argius AS-014); *3* — dual-circuit ejector pulsejets; *4* — turbojets including those with afterburners; and horizontal line — rocket engines

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