ESTIMATION OF THE INFLUENCE OF THE WATER VAPOR CONCENTRATION IN A HEATED AIR ON THE CHARACTERISTICS OF THE OPERATION PROCESS IN A MODEL COMBUSTOR WITH CONDENSED ENERGY-INTENSIVE MATERIAL

E. V. Surikov[1], M. S. Sharov[1], P. A. Kolomentsev[1], O. M. Alekseeva[1], A. V. Fedorichev[2], and D. V. Zhesterev[2]

[1] P. I. Baranov Central Institute of Aviation Motors, 2 Aviamotornaya Str., Moscow 111116, Russian Federation
[2] FSUE "The Federal Center for Dual-Use Technologies "Soyuz," 42 Acad. Zhukova Str., Dzerzhinsky, Moscow Region 140090, Russian Federation

Abstract: Presented are the results of experimental studies on estimating the influence of the water vapor concentration in the vitiated airflow preheated to 550 K, which may occur when using a hydrogen fire-heater, on the operation process in the combustor of the model facility with condensed energy-intensive material. A significant effect of the water vapor content on slagging of the heat-protective coating surfaces and heat exchange with the walls in the combustor is detected. A decrease in the combustion efficiency of the condensed energy-intensive material in the presence of 2–3 %(wt.) water vapor in the air flow under specified conditions was registered.

Keywords: model combustor; combustion efficiency; vitiated air; water vapor; condensed energy-intensive material

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Figure Captions

Figure 1 Schematic of the model installation: *1* — gas generator; *2* — charge of energy-intensive condensed material; *3* — ignition system; *4* — nozzle end of the gas generator; *5* — replaceable nozzle inserts; *6* — combustor flow path; *7* — heat-protective coating of combustor; *8* — nozzle unit; and *9* — air supply channels

Figure 2 Schematic of the test section of the test rig with an attached air supply pipeline and a water supply system to the air main: *1* — heated air supply line; *2* — electric air heater; *3* — cold air supply line; *4* — mixer; *5* — distilled water tank with supercharging system; *6* — water supply line; *7* — common measuring nozzle; *8* — bypass pipeline; *9* — nitrogen supply line; *10* — metal hose for impulse-free air supply; *11* — receiver; *12* — compression tapes; *13* — model installation; *14* — dynamometer platform; *15* — exhaust pipe; and *16* — cyclone

Figure 3 View of the surface of the outlet sleeve of the heat-protective coating in the combustor after the test: (*a*) test No. 3 without water supply; and (*b*) test No. 4 with water supply

Table Captions

Table 1 Test mode parameters and main results

Table 2 Results of determining the volume of condensed combustion products deposited on the surface of the tail sleeve of the heat-protective coating in the combustor after the test

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Contributors

Surikov Evgeny V. (b. 1950) — Candidate of Science in technology, head of sector, Engines and Chemmotology Department, P. I. Baranov Central Institute of Aviation Motors, 2 Aviamotornaya Str., Moscow 111116, Russian Federation; evsurikov@ciam.ru

Sharov Mikhail S. (b. 1982) — Candidate of Science in technology, senior research scientist, Engines and Chemmotology Department, P. I. Baranov Central Institute of Aviation Motors, 2 Aviamotornaya Str., Moscow 111116, Russian Federation; mssharov@ciam.ru

Kolomentsev Petr A. (b. 1987) — test engineer, Engines and Chemmotology Department, P. I. Baranov Central Institute of Aviation Motors, 2 Aviamotornaya Str., Moscow 111116, Russian Federation; kolomentsev@ciam.ru

Alekseeva Olga M. (b. 1986) — test engineer, Engines and Chemmotology Department, P. I. Baranov Central Institute of Aviation Motors, 2 Aviamotornaya Str., Moscow 111116, Russian Federation; alekseeva@ciam.ru

Fedorichev Alexander V. (b. 1956) — head of laboratory, FSUE "The Federal Center for Dual-Use Technologies "Soyuz," 42 Acad. Zhukova Str., Dzerzhinsky, Moscow Region 140090, Russian Federation; dgr56@mail.ru

Zhesterev Denis V. (b. 1985) — head of group, FSUE "The Federal Center for Dual-Use Technologies "Soyuz," 42 Acad. Zhukova Str., Dzerzhinsky, Moscow Region 140090, Russian Federation; d_zhesterev@mail.ru