Supersonic flows features in narrow cylindrical ducts

© A.V. Voronetsky, S.A. Suchkov, L.A. Filimonov

Scientific Research Institute for Power Engineering at Bauman Moscow State Technical University, Moscow, 105005, Russia

The article gives the results of numerical and theoretical research on features of high-enthalpy supersonic flows in narrow cylindrical ducts. Mathematical model is based on non- stationary axisymmetric Navier— Stokes complete equation system. Calculations are made for ducts of different length at laminar and turbulent flow modes with various turbulence models. The article analyzes influence of ducts geometric parameters on flow characteristics. The author studies peculiarities of Mach number distributions along radius of the ducts at different cross-sections. The article shows that supersonic flow deceleration occurs in the ducts and intensity of the deceleration depends on considered conditions and can cause formation sub-sonic flow zone of considerable length.

Keywords: *Supersonic flow, cylindrical ducts, turbulence model, Mach number.*

Voronetsky A.V. (b.1946) graduated from Bauman Moscow Higher Technical School in 1970. Dr. Sci. (Eng.), Professor, Honored Scientist of the Russian Federation, Head of the Department of the Scientific Research Institute for Power Engineering at Bauman Moscow State Technical University. Author of more than 100 scientific papers in the field of heat and mass transfer in two-phase flows. e-mail: voron@mx.bmstu.ru

Suchkov S.A. (b.1967) graduated from Bauman Moscow State Technical University in 1990. A Researcher of the Scientific Research Institute for Power Engineering at Bauman Moscow State Technical University. Author of more than 20 scientific publications in the field of mathematical modeling of heat and mass transfer in multi-phase flows. e-mail: ss@el.bmstu.ru

Filimonov L.A. (b.1962) graduated from Bauman Moscow Higher Technical School in 1987. A Researcher of the Scientific Research Institute for Power Engineering at Bauman Moscow State Technical University. Author of more than 20 scientific publications in the field of mathematical modeling of heat and mass transfer in multi-phase flows. e-mail: voron@mx.bmstu.ru