Study of the boundary layer interaction with the bow shock at supersonic flow around a blunt body

Lapushkina T A[1,2,@], Kolesnik E V[2], Popov P A[1], Monahov N A[1] and Belov K I[1]

[1] Ioffe Institute, Polytekhnicheskaya 26, Saint-Petersburg 194021, Russia
[2] Peter the Great Saint-Petersburg Polytechnic University, Polytechnicheskaya 29, Saint-Petersburg 195251, Russia

[@] tanyusha@mail.ioffe.ru

The work is studied the influence of a growing boundary layer on the supersonic flow around an aerodynamic body. The task is to select and implement in an experiment the parameters of a supersonic flow and to study the flow pattern near the surface of an aerodynamic body at different viscosity values of the incoming supersonic flow with visualization of both as the emerging shock wave configuration as the boundary layer in front of the body and to study the change in the pressure field in the flow region under these conditions. The experiment is carried out on an experimental stand created on the basis of a shock tube. A low pressure chamber is connected to a working chamber in which a flat supersonic nozzle with a width of 40 mm is located. The aerodynamic body under study is placed in the nozzle at a distance while the Mach number of the flow incident on the body is in the range from 5 to 7. The model is clamped by lateral transparent walls, which are simultaneously a source of boundary layer growth and viewing windows for visualizing the flow. For selected modes with Reynolds numbers from 8200 to 45000, the work obtained schlieren flow patterns and pressure distribution fields near streamlined models of two configurations. Data show that a complex unsteady flow pattern is realized near the model. In Schlieren pictures a "splitting" of the shock wave front is observed, which can be interpreted as a curvature of the front caused by the viscous-inviscid interaction of the boundary layer with the bow shock near the wall. The work is supported by the Russian Science Foundation (project No. 23-29-00286).