Modelling of reflected shock bifurcation in a cylindrical channel

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Shock tube is one of the most oftenly used tool for chemical kinetics study. Herewith, gas-dynamic non-uniformities could affect the chemical process significantly, so it is important to understand how exactly such non-uniformities arise and develop. In particular, the interaction of reflected shock wave with a boundary layer is of research interest. This phenomenon was in general explained in the model proposed by Mark [1] and further was studied in numerous experimental works (see e.g. [2]). At the same time, the numerical representation of the phenomenon on the quantitative level is still not reached. In the present work the dynamics and parameters of the reflected shock wave interacting with the boundary layer are studied numerically in argon, in air, and in a hydrogen–nitrogen mixture for Mach numbers M = 1.3–3.5 in a 76-mm-diameter smooth shock tube. Non-slip isothermal boundary conditions were set up on the channel walls.

The calculations show a satisfactory agreement with the experiments [2] in terms of axial projection of the oblique shock wave, axial flow distance and triple-point height.

[1] Mark H 1958 *The interaction of a reflected shock wave with the boundary layer in a shock tube* (Cornell University, Ithaca, New York: NASA TM-1418)

[2] Penyazkov O and Skilandz A 2017 *Shock Waves* **28** 299–309