Non-equilibrium condensation of a vapour-gas mixture on a shock-tube endwall behind a reflected shock wave

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A filmwise condensation of a vapour-gas mixture induced by a reflected shock wave on a shock-tube endwall is theoretically investigated. Gas dynamics equations for the mixture and heat conduction equations for both a liquid film and the endwall are solved under molecular gas dynamical boundary conditions by the method of matched asymptotic expansions. It is clarified that interfacial fluid dynamical quantities of the mixture and the growth behaviour of the film are influenced by the existence of a noncondensable gas depending on its initial concentrations. For example, the initial noncondensable gas concentration of 0.1% has only a slight influence on the growth rate of the film, while the initial concentrations of a few percents largely influence it because the noncondensable gas accumulates at the surface of the film and suppresses the growth rate of the film.