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Effects of Prandtl number on the formation and evolution of single laminar plume.[1] PEI-JIANG QIN, ZE-XU LI, LIN SUN, SHI-DI HUANG, Department of Mechanics and Aerospace Engineering, Southern University of Science and Technology — In this work, the formation and evolution processes of single laminar plume is studied over the Prandtl (Pr) number range of 50˜1000 by using shadow visualization technology. The heating power input is shut down immediately once a single plume is formed. It is found that the plume formation time increases with Pr number increasing, and the exponent of Pr-dependent power law decreases as the flux Rayleigh number Ra_F (i.e. the heating power) increases. After its formation, the plume first undergoes an accelerated ascending process, and then decelerates after reaching a maximum velocity, without a uniform ascending region as observed in previous studies. Both the maximum velocity and acceleration are decreased as Pr number increases, and their Pr number dependencies become weaker for larger Ra_F numbers. We also examine how the spanwise width of single laminar plume changes during its rising process, and the results are compared with previous studies.

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