

High temperature phenomena in shock waves

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Abstrak

The high temperatures generated in gases by shock waves give rise to physical and chemical phenomena such as molecular vibrational excitation, dissociation, ionization, chemical reactions and inherently related radiation. In continuum regime, these processes start from the wave front, so that generally the gaseous media behind shock waves may be in a thermodynamic and chemical non-equilibrium state.

This book presents the state of knowledge of these phenomena. Thus, the thermodynamic properties of high temperature gases, including the plasma state are described, as well as the kinetics of the various chemical phenomena cited above. Numerous results of measurement and computation of vibrational relaxation times, dissociation and reaction rate constants are given, and various ionization and radiative mechanisms and processes are presented. The coupling between these different phenomena is taken into account as well as their interaction with the flow-field. Particular points such as the case of rarefied flows and the inside of the shock wave itself are also examined. Examples of specific non-equilibrium flows are given, generally corresponding to those encountered during spatial missions or in shock tube experiments.