# Passive and active laser methods for studying the kinetics of high-temperature reactions in shock tubes.

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The shock tube is one of the most versatile and precision instruments for studying the kinetics of high-temperature reactions in gaseous and heterogeneous media. The simplicity of varying over a wide range and reliable control of temperature, pressure and mixture composition makes it possible to study a wide variety of classes of nonequilibrium processes, ranging from relaxation of the internal degrees of freedom of molecules to chemical and plasma reactions, including the processes of formation and transformation of condensed nanoparticles.

Of course, the possibilities of a detailed analysis of nonequilibrium processes occurring behind shock waves are completely determined by the use of a diversity of modern diagnostic methods. Among such methods, various laser methods occupy a special place. As laser technology develops, their capabilities expand significantly and, accordingly, new methods of their application are developed. In this review, we tried to present the possibilities and specifics of using various laser methods to study the kinetics of nonequilibrium processes behind shock waves. Wherein, we divided all existing laser methods into passive and active. We classified as passive methods those methods in which changes in the parameters of the laser beam itself when passing through the studied mixture are recorded, and changes in the parameters of this mixture under the influence of laser radiation can be neglected. In turn, active methods are those in which laser exposure changes the parameters of the medium under study and the change in these parameters that occurs as a result of laser exposure that is recorded. Both methods provide the ability to monitor changes in both integral parameters of the medium, such as temperature, density or volume fraction of the condensed phase, and detailed characteristics of the medium - concentrations of separate components (molecules, radicals, or even populations of separate states), sizes, optical and thermodynamic properties of condensed particles, etc.

The review provides examples of the use of various laser methods, illustrating the wide possibilities and rich prospects for studying complex nonequilibrium processes that open up when a shock tube is combined with modern laser technique.