CONTEMPORARY DIAGNOSTIC TECHNIQUES FOR SELF-PROPAGATING HIGH TEMPERATURE SYNTHESIS

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Self-propagating high temperature synthesis (SHS) is a promising method for synthesis of a wide variety of advanced materials in the combustion mode. Therefore, fundamental and applied study of this process must include not only common characteristics of combustion (such as propagating velocity, temperature profiles, etc.), but also main features of the desired product structure formation. In the present work, we consider both the traditional and novel methods of experimental diagnostics and their applications for SHS processes.

Methods of image recording traditionally play an important role in the combustion science.. Development of these methods, from photography to digital high-speed micro video recording and thermal vision systems is overviewed. New fundamental approaches arisen due to these methods (e.g., discrete models of the combustion waves) are discussed.

Various methods for temperature profile measurement (micro-thermocouples, micro-pyrometry) are examined from the viewpoint of withdrawing kinetic information from the profile.

Quenching of the SHS wave provides a unique possibility to obtain data concerning dynamics of microstructure formation of the products. However, adequate quantitative data can be obtained only if the quenching procedure fulfils certain conditions, which are analyzed in this work.

A novel powerful method for *in situ* study of the crystal structure evolution, time-resolved X-ray diffraction (TRXRD) has attracted a great interest recently. Utilizing synchrotron radiation for obtaining diffraction patterns allows one to reduce the time of one pattern acquisition down to 1 ms or even less. Thus, the sequence of phases formation and mechanisms of a heterogeneous reaction can be monitored directly during the high temperature synthesis.

Possibilities of some other methods, such as electric probe, light spectroscopy, deformation measurements, etc. are shortly outlined.

Finally, combining different techniques in order to obtain complementary data and build a comprehensive picture of combustion and structure formation in SHS is discussed.

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