

Preface

When the authors were young, though already passionate about science, they were fortunate to learn about a newly developed method of self-propagating high-temperature synthesis (SHS). Thanks to personal contacts and active cooperation with a research team working in this new R&D area under the supervision of Prof. A. G. Merzhanov¹ in the Department of Macrokinetics at the Institute of Chemical Physics of the USSR Academy of Sciences, the authors arrived at a conclusion about the excellent prospects for this technological method in the synthesis of new inorganic materials. An SHS research group was also established at the Tbilisi Institute of Metallurgy.² The Institute of Structural Macrokinetics RAS and Materials Science in Russia became a center for applied and theoretical studies in the field of SHS. Close cooperation between these two research centers and the joint creative work of the authors of this book in the area of synthesis of hard alloys resulted in the creation of a systematic scientific approach which makes possible the successful utilization of SHS-based production methods on an industrial scale.

The SHS production method is one of the youngest technologies used for the synthesis of a wide range of refractory, corrosion-resistant, super-hard advanced materials and specialty items. SHS research schools have now been established in Russia, China, India, Poland, Spain, USA, and France, among other countries. SHS processes are actively studied by research groups in 47 countries including Georgia.

Some of the experimental and theoretical results obtained by the Georgian SHS team are summarized in this book. Co-authorship with A. S. Shteinberg provides an excellent example of international cooperation and serves to broaden the range of SHS-related issues discussed in the book.

¹ Currently a Member of the Russian Academy of Sciences, A. G. Merzhanov is a chief scientific advisor at the Institute of Structural Macrokinetics and Materials Science RAS.

² Presently the Ferdinand Tavadze Institute of Metallurgy and Materials Science.

Despite challenging times for science, a research group supervised by G. F. Tavadze has collected numerous experimental data. Various SHS-based methods have been employed and improved in the laboratory, while quite a few alloys and materials characterized by special (or in a number of cases, unique) properties have been synthesized. These materials have been used successfully for the resolution of a number of engineering problems and offer excellent prospects for utilization in industry.

This book also discusses some of the results obtained at the Laboratory of Manufacturing Processes and Materials Science of SHS products and rapidly melt-quenched alloys of the Institute of Metallurgy and Materials Science as they pertain to the following areas:

- synthesis and characterization of boron and its compounds (B_4C , BN);
- fabrication of composite ceramic and metal–ceramic materials;
- synthesis of functionally graded alloys and fabrication of items via a single-stage synthesis—including process.

The authors are grateful to the research group members who played an active part in the experiments and to Dzhumbar Varlamovich Khantadze, D.Sci. for useful discussions during preparation of the manuscript.

It is our hope that this book, which can be considered the result of successful collaborative research, will prove useful and helpful to materials science specialists committed to the development and study of refractory, wear-resistant, antifrictional, and other advanced materials.

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Production of Advanced Materials by Methods of
Self-Propagating High-Temperature Synthesis

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2013, XIX, 156 p. 106 illus., Softcover

ISBN: 978-3-642-35204-1