Final conclusions

Self-propagating high-temperature synthesis (SHS) can be used to produce quality solid solutions in Al-Si-C-N, Ti-Si-C-N and Ti-Si-N systems. This, however, is conditioned upon correct identification of process mechanisms giving control over the course of reaction, which in effect enables obtaining repeatable products. One of the effective means of controlling the course of synthesis is adding silicon nitride to the reaction bed. It works as an additional source of substrates and simultaneously modifies the course of the process, leading to obtaining the desired phases. Addition of silicon nitride forces the reaction to go through several stages, which in turn allows the products to crystallise in the form of solid solutions and not the mixture of simple carbide and nitride compounds. An unquestionable advantage of running SHS with the addition of silicon nitride is the possibility to lower nitrogen pressure during the process. A good example of this effect is visible during crystallisation of AlN-SiC solid solution, which works best at 1 bar nitrogen pressure.

Silicon nitride occurring as an intermediate product of the SHS reaction in Si-C-N system offers the possibility of obtaining silicon carbide nanopowders. Currently only few methods of obtaining nanopowders are known, with efficiencies below twenty grams per hour. Self-propagating high-temperature synthesis in Si-C-N system is an extremely rare example of a nanopowder technology yielding several hundred grams of product in a single run. The whole process starting with placing a reaction bed in a high-pressure chamber and ending with the removal of ready products takes about one hour. SHS method is therefore one of very few technologies for obtaining sub-micron SiC grains in such a short time. Efficiency of this process encourages further investigations and most of all application of SHS on a broader scale.

Presented monograph describes a part of author's long-term investigation on self-propagating high-temperature synthesis and advanced ceramic construction materials. Many material aspects of obtained compounds and solid solutions are omitted from this work. Results of that research can be found in separate publications of the author. Data presented herein often has a form of comments referring to works of other authors' from Japanese and American centres. An important intention of the author, realised in this monograph, was to put own results in the picture of currently developed new ways of investigating SHS. Author's results can form a good starting point for further investigation on the possibility of controlling the self-propagating high-temperature synthesis – SHS.