Editorial

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The development of highly efficient thermoelectric energy converters is one of the highest priority scientific and engineering tasks in industrially developed countries. The growing interest in this topic is due to the large (and often unique) role played by thermoelectric generators in the power supply of spacecraft for deep space exploration, power supply of remote objects in exploration of the Arctic, as well as the involvement of a huge amount of unused (“waste”) thermal energy into the energy turnover. Recent years have been marked by tremendous progress in the field of increasing the thermoelectric efficiency of low, medium, and high temperature thermoelectric materials. Approaches based on a decrease in thermal conductivity and optimization of electronic properties due to nanostructuring and engineering of the band structure have made it possible to develop materials with thermoelectric figure of merit $ZT > 1.5$ in the temperature range 100–900°C.

In the Russian Federation, research and development of thermoelectric materials and devices is actively pursued by groups and laboratories of many scientific and educational institutions, among which the Ioffe Institute, Russian Academy of Sciences, National Research Center Kurchatov Institute, M.V. Lomonosov Moscow State University, National Research University MIET, Belgorod National Research University, National Research Technological University MISiS, are worth mentioning.

This thematic issue presents both review papers reflecting the main trends and achievements in the field of thermoelectric materials and original papers devoted to the fundamental and practical aspects of modern thermoelectric materials. The current state of

research in a wide range of thermoelectric materials, ranging from “classical” chalcogenide thermoelectrics to Zintl phases, Heusler alloys, and oxyselenide thermoelectrics, is presented in reviews of the authors’ teams from the Kurchatov Institute, NUST MISiS, and the National Institute for Materials Science (Japan). The topological features of thermoelectrics based on bismuth telluride are described in a review by a team of authors from the Ioffe Institute. Several papers present the original results of studies of multi-component solid solutions of chalcogenide compounds, the study of the effect of doping and the structural state on the thermoelectric properties of zinc oxide, chalcopyrite AgInSe_2 , and cuprates Cu_{2-x}Se . A series of articles by scientists from the Ioffe Institute is dedicated to polymer matrix and silicide thermoelectrics of CoSi , CrSi , and Mg_2Si ; the evolution of their properties upon doping; crystallization from an amorphous state, and the incorporation of nanoinclusions. Practical aspects of thermoelectrics are devoted to considering a new fuel element and discussing the optimal efficiency of thermoelectric generators.

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