

Preface

This book covers the problems of theory and practice of developing core elements for a high-temperature Nuclear Rocket Engine reactor (NRER). As a concept, the problem is solved through a non-separable interrelation of the structure, properties and performance patterns of the structural elements. Due to high brittleness of materials used in a structure, on the basis of interstitial phases, i.e., carbides, nitrides, hydrides, special focus is put onto reasoning stability of the core elements being exposed to high heat and neutron flux, high stresses, aggressive gases, and ultra-high temperature. Such a variety of performance parameters required development of a whole range of new pre-reactor and reactor methods of material testing and execution of a complex investigation of the basics for the structure formation of these materials, in order to ensure the maximal reliability of the structures operation. Development of Fuel Elements (FE), simple by their shape, but operating under extremely heavy conditions, required involvement of the experts in various sciences, such as physics, mechanics, heat engineering, reactor and radiation material science, production technologies of nuclear fuel, and structural materials. The developed phenomenological and statistical-thermodynamic theories of three-component interstitial alloys and the set of laws for modification of diffusion-controllable processes (creep, sintering, carbonizations, and corrosion) have deepened present scientific presentation of these processes and have got wide recognition in the scientific community. Doubtless interest is presented also on irradiation behavior of carbide materials and bearing capacity of fuel and constructional materials on the basis of interstitial phases in conditions of an irradiation neutron fluxes.

There are numerous separate works discussing development and production of FEs for thermal neutron and fast neutron reactors, but there is no book covering a problem of developing core elements for Fuel Assemblies (FA) integrally. The fact, that results of exploring on the NRE reactor are disseminated under various publications of periodic journals or express collections, access to which is complicated and own experience are great, so it became the incentive reason for writing this monograph in which data on a resolving of a problem of FA creation for high-temperature solid phase NRE reactor, characteristics of materials and

principles of designing are generalized. Author realizes that the frame of concerned subjects in a book is restricted. Many problems of design, neutron-physical and hydro dynamical characteristics of the NRE reactor are handled in the book *Nuclear rocket engines* [1].

Many scientific investigators and engineer's of the Research Institute of Production Research Association (RIPRA) "Luch" participated in a development, manufacturing and material tests of the NRE are presented in this book [2]. The circle of authors shared in creation of the NRE is rather wide and, certainly, is not terminated by the authors presented in the bibliographic list of this book. Many actively worked authors who died, did not publish in due time their manuscripts in the open printing. So it should note the big contribution of Ph.D. N. Poltoratsky and Doctor of Science L. B. Nezhevenko in the development of the fuel elements technology HRA from carbide and carbide-graphite materials and Ph.D. A. L. Epstein for the material science organization and technological works on neutron moderator from hydrides of zirconium and yttrium. The author remembers the creative contacts with them with gratitude, and also a fruitful cooperation with many workers with whom he had the luck to work at the NRE elaboration in scientific research institute of RIPRA "LUCH" since 1962 year.

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2. RIPRA "Luch". (2004). Affairs and people. Podolsk. RIPRA "LUCH". Ed. Fedik I. I. Podolsk, 455 p.

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