

Preface

In nuclear power generation establishing the performance of a fuel calls for collective effort of scientists and technologists for addressing various issues of front and back ends of the fuel cycle. These issues pertain to all the operational aspects for smooth functioning right from fuel resourcing, mining and purification, fuel pin fabrication, reactor irradiation, fuel reprocessing, and management of radioactive wastes. Safety, security, and economy are to be met in the fuel cycle management. Typically nuclear fuels are irradiated in reactors for several decades for deriving power from them. Therefore, a thorough understanding of thermal and thermodynamic properties of the fuel materials is necessary for the evaluation of its performance under these conditions. Reliable data acquisitions are thus carried out for the thermal expansion, thermal conductivity, heat capacity, phase stability of the fuel, and thermodynamic and transport properties of fission products that are formed in the fuel matrix. With the additional knowledge of the transport properties of fission-released oxygen in the case of oxide fuels, the chemical states of the redistributed fission products are evaluated for ensuring containment of the clad fuel.

Many countries, particularly those having abundant resource of thorium, envisage nuclear power production from this fertile-actinide. The envisaged policy for the thorium-based reactor technology is toward reducing burden to the enriched uranium-based conventional fuels. Thorium-based fuels have the general merits of greater abundance of the element on earth crust, superior physical and nuclear properties, particularly in oxide form, better resistance to weapons proliferation and lesser production of heavier actinides in reactor irradiation. There has been worldwide effort to establish the thorium-based reactor technology and thus a large database on the thermophysical, thermodynamic and transport properties of thorium based fuels, and detailed technical information on the fuel fabrication, reprocessing and waste management exists in the literature. In this context, it is necessary to consolidate the accumulated information at one place, in the form of a book that essentially covers the scientific and technological information on all the stated aspects of thorium-based fuels. With this objective, the chapters in this book are organized accordingly and are written by experts in the respective fields, who collectively contributed to the thorium utilization program in India. The arrangement of chapters has been carefully planned to provide the readers with adequate state-of-art knowledge regarding thorium fuels. We believe that the

scientific and technical information in this book will serve as a ready reference to researchers and technologists working in the field of thorium utilization.

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