

Preface

The ideas of this book emerged from the experience of the author with student courses on high temperature materials and on nuclear materials performed at the Swiss Federal Institutes of Technology in Zürich and Lausanne. Particularly the creation of the new Swiss Master of Nuclear Engineering demonstrated the need for a comprehensive introduction into structural nuclear materials with specific emphasis on engineering aspects. An introduction into structural materials operating in extreme environments is a real challenge because of the variety of topics involved. This is true for nuclear applications, but it also concerns materials for turbines, boilers, vessels or pipes necessary for non-nuclear plants or components. Understanding of the behaviour of components and possible damage includes information about microstructure, materials mechanics, fracture mechanics, influence of environment (radiation, corrosion) but it also needs basic knowledge about design, production, shaping and non-destructive testing. And finally in almost all cases economic considerations decide about introduction of new materials. The students usually have very different educational backgrounds and the majority of them knows only very little about materials, materials mechanics and related topics and it is therefore important to touch also upon elementary questions of materials science as a basis for better understanding.

Personal experience with nuclear engineers working in power plants or in design code related environments indicated that also from their side a broader introduction into the subject of structural nuclear materials would be appreciated.

When Switzerland entered the international Generation IV initiative in 2004 I became Swiss representative in the Very High Temperature Reactor (VHTR) Systems Steering Committee and I was also co-chair of the VHTR Project Management Board Materials which provided a thorough insight into relevant structural materials problems in advanced nuclear plants.

The Swiss Paul Scherrer Institute supported the creation of the project “High Temperature Materials for Advanced Nuclear Plants” (HT-MAT) where I had the opportunity to perform advanced research with a group of very well educated and enthusiastically working individuals who brought a significant input into this book. In particular I would like to acknowledge the work of:

Manuel Pouchon in the field of materials physics and micro sample testing
Jiachao Chen in the field of irradiation damage, irradiation creep and advanced
transmission electron microscopy
Maria Samaras in the field of materials modelling (in general) and molecular
dynamics
Annick Froideval for performing advanced beamline analyses
Botond Bako and Peter Ispanovity for dislocation dynamics
Ann-Christine Uldry and Roberto Iglesias for ab initio modeling
Tomislav Rebac for his skilled experimental work.

My thanks go also to ASME and ASME LIC for providing the possibility to
contribute to code development. Some work included in the book was performed in
projects which were funded by the European Communities (RAPHAEL,
EXTREMAT, GETMAT and MATTER).

Oberrohrdorf, Switzerland, November 2011

Wolfgang Hoffelner

<http://www.springer.com/978-1-4471-2914-1>

Materials for Nuclear Plants

From Safe Design to Residual Life Assessments

Hoffelner, W.

2013, XXX, 482 p., Hardcover

ISBN: 978-1-4471-2914-1