BOOK REVIEW

Properties of Fluorite Structure Materials

Editors: Peter Vajda (Laboratoire des Solides Irradiés, Ecole Polytechnique, CNRS-CEA, Palaiseau, France) and Jean-Marc Costantini (CEA Saclay, DMN/SRMA, Gif sur Yvette, France)

Calcium fluoride, CaF_2, occurs naturally as the mineral fluorite which lends its name to the deceptively simple cubic structure of four FCC Ca atoms and eight tetrahedrally coordinated F atoms. In simplicity often lies rich diversity, this is certainly the case with materials with the fluorite structure. The book "Properties of Fluorite Structure Materials" Edited by Peter Vajda and Jean-Marc Costantini demonstrates how such diversity in fluorite materials arrives from small changes in stoichiometry.

"Properties of Fluorite Structure Materials" Edited by Peter Vajda and Jean-Marc Costantini covers a wide range of research based solely on those materials with the fluorite structure. A common theme running through the book is the impact of non-stoichiometry on the diverse range of properties. In fact, an appropriate sub-title or alternate title could be "The impact of non-stoichiometry on the properties of fluorite materials." This book can be considered a follow on to "Crystals with the Fluorite Structure" edited by W. Hayes and published in 1974. The book by Hayes focused mainly on point defects in fluorite structure materials while the current book emphasizes non-stoichometry.

The book contains six chapters covering the rare-earth (and actinide) di-hydrides and irradiation induced properties in lithium oxide, cubic-stabilized Zirconium and Ceria, and actinide compounds. If the book was longer it could be divided into two parts, the metal hydrides and radiation induced damage. The importance of non-stochiometry in the metal hydrides is demonstrated with first-principles calculations and experiments revealing changes in their electronic and magnetic properties as a function of hydride stoichiometry. Similarly, changes in stoichiometry induced by radiation damage are manifested in changes to the properties of LiO_2, ZrO_{2-x} and $CerO_{2-x}$, and a variety of actinide compounds. Non-stoichiometry, whether induced via an outside force or intentionally introduced, seems to have a drastic and interesting impact on the properties of fluorite materials.

Each chapter is of appropriate length and technical depth to provide an excellent review of the topic. A researcher in these areas would be well served to use these chapters as a starting point for further study. However, a book must be judged not only on its written content but also on its presentation. While the content of the book is excellent, the presentation in some chapters is lacking. My greatest complaint is in the quality of the figures in some chapters, especially those figures in Chapters 2 and 3. The figures are blurry and appear to be scanned copies rather than originals. It is unfortunate because these figures detract from an excellent technical book.

While no human product is perfect this book serves as a valuable contribution to the scientific literature. Each chapter stands alone as a solid introduction to that particular field. Who knew such a simple crystal structure could yield such fascinating science.

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