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Book Review

Defect Structure and Properties of Nanomaterials

Second and Extended Edition, Jenõ Gubicza (Ed.). Woodhead Publishing, Cambridge, UK, 2017, 410 pp. ISBN: 0081019173.

Nanostructured materials and nanomaterials have been an important subject of study in the Materials Science community, especially in the last two decades. Many researchers strive to construct unique microstructures in bulk solids and characterize the exceptional physical and mechanical properties and additional functionalities of the nanomaterials. The synthesized nanostructured materials demonstrate significant changes in microstructure, crystallographic texture, and defect structure, such as vacancies, dislocation density, stacking fault and twins, and grain boundaries depend on the processing techniques and methods. Thus, the knowledge of processing techniques and the characterization procedures are key for a better understanding of the nanostructured materials. It is for this reason that the new edition of *Defect Structure and Properties of Nanomaterials*, written by Prof. Jenõ Gubicza, is designed to bridge the knowledge gap between processing, defect structure, and the various properties of nanostructured materials.

This book contains the information required to understand the lattice defects in nanostructured materials processed by various plastic deformation techniques and their effects on material function. The book is divided into 12 chapters. It opens with a review of processing methods for nanostructured materials through both "bottom-up" and "top-down" approaches, the first part of the book (Chapters 2–6 and 8) progresses through the defect structures in bulk nanostructured materials, nanoparticles and nanomaterials sintered from nanopowders, thin films and multilayers, and metal matrix-carbon nanotube composites. The second part of the book (Chapters 7 and 9–12) focuses on the significance of the defect structures on mechanical properties and additional functionalities, including the electric resistivity, diffusivity, hydrogen storage capability, and thermal conductivity of the nanostructured materials. The logically categorized chapters make this book a useful resource for a wide range of readers from professionals, including physicists, metallurgists, and materials scientists and engineers, to young scientists and university students.

In the abundant information in the book, Chapter 2 provides an authoritative overview of the characterization techniques with the direct and indirect procedures for examining lattice defects in nanostructured materials. Special guidance is given to the indirect methods, including X-ray line profile analysis, and the majority of the data in the book are obtained using these methods. As the author states, indirect analysis gives good statistics of lattice defects in the large volume of nanostructured materials, while the direct methods of microstructural observation reveal the distinct features of the defect structure, albeit in a limited area of the nanomaterials. A comparison of the features of the characterization techniques complements the contents of the book and it provides an insight for all experimentalists to realize the available examination area and volume of the specimens and the detectable range and limit of lattice defects.

The major strengths of this book can be determined from these three key aspects. First, numerous schematic and idealized illustrations of the defect formations in nanocrystalline microstructure are displayed throughout the entire book. These are well presented and allow the reader to better understand the behavior and characters of lattice defects in the specific structures of nanomaterials synthesized by different techniques. Second, the inclusion of a good number of transmission electron micrographs provides a real sense of the lattice defects in the prepared nanostructured materials. Third, comprehensive tables are provided that list the quantitative results available for nanocrystalline size, densities of lattice defects, and corresponding mechanical properties and other functional properties of each nanostructured material processed by a specific technique. These numerical data help to visualize the significance of lattice defects on the physical and mechanical properties of the nanostructured materials.

In conclusion, this latest edition of *Defect Structure and Properties of Nanomaterials* will be highly appreciated by anybody who wishes to study and learn available techniques to process nanostructured materials and the effects of lattice defects in the nanomaterials. The book allows readers to study the significance of lattice defects in a wide range of nanomaterials.

Megumi Kawasaki
School of Mechanical, Industrial and Manufacturing Engineering
Oregon State University
Corvallis, OR, USA

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