

Preface

Defect charging can affect numerous aspects of defect properties, including physical structure, rate of diffusion, chemical reactivity, and interactions with the electrons that give the semiconductor its overall characteristics. This book represents the first comprehensive account of the behavior of electrically charged defects in semiconductors. A comprehensive understanding of such behavior enables “defect engineering,” whereby material performance can be improved by controlling bulk and surface defect behavior. Applications are important and diverse, including fabrication of microelectronic devices, energy production from solar power, catalysis for producing chemical products, photocatalysis for environmental remediation, and solid-state sensors. The scope of this book is quite large, which helps to identify classes of behavior that are not as readily evident from an examination of defect charging in a narrower material- or application-specific context. The text summarizes current knowledge based on experiments and computations regarding defect structure, thermodynamics, and diffusion for both bulk and surfaces in an integrated way.

Indeed, defect charging effects continue to be a fertile area of scientific research, with new phenomena coming to light during the past decade. Such effects include ion-induced defect formation, photostimulated surface and bulk diffusion, and electrostatically-mediated surface interactions with bulk defects. The present work outlines key aspects of these new findings.

The most sophisticated forms of practical defect engineering have developed within the context of microelectronic device fabrication, particularly in silicon. Yet such engineering will almost certainly spread more broadly into other domains such as semiconductor-based sensors and solar energy devices. The present work does not attempt to review these advances in detail, but does point to more extensive reviews where they exist.

In general, though, we hope that the scope and integration found in this book will stimulate new scientific findings and offer a new basis for new forms of defect engineering.

Urbana, Illinois, USA, July 2008

Edmund G. Seebauer
Meredith C. Kratzer

Charged Semiconductor Defects

Structure, Thermodynamics and Diffusion

Seebauer, E.G.; Kratzer, M.C.

2009, XIV, 298 p., Hardcover

ISBN: 978-1-84882-058-6