Chapter 9 presents several synthesis methods, such as mechanical exfoliation, liquid-phase exfoliation, epitaxial growth, and variants of chemical vapor deposition. Chapter 10 focuses on thermal and mechanical properties of graphene and SWCNTs. This is followed by a discussion of chemical modification of graphene, mainly hydrogenation and fluorination of graphene, in chapter 11. Finally, chapter 12 presents applications of CNTs and graphene in electronic devices, tissue engineering, and drug delivery. Biocompatibility issues are also presented. A set of three appendices deal with Raman scattering, tight-binding theory, and x-ray diffraction.

While there is a rich body of literature on the properties of CNTs and graphene-based materials, this volume is intended to introduce the beginner to fundamental concepts. The book is well written and is at a level accessible to undergraduate students. The text is supported by illustrations, tables, and micrographs. It lacks a list of exercises, although a manual of homework problems and solutions is available from the publisher. There is a sizable list of references at the end of each chapter and an excellent bibliography at the end of the book.

The organization of the chapters is a bit haphazard. For instance, synthesis is buried between characterization and mechanical properties, which is followed by chemical modification. Moreover, there is no discussion of modeling and simulation, which have made key contributions to our understanding of these materials. The authors have also avoided significant discussion of graphene oxide, which has tremendous potential in selective separation and energy technologies. Overall, this volume serves as a good reference for the beginner interested in pursuing research in graphene and related materials.

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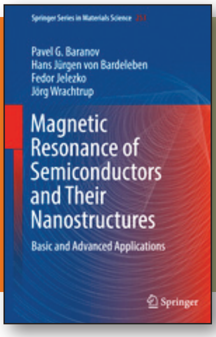

Magnetic Resonance of Semiconductors and Their Nanostructures: Basic and Advanced Applications

Pavel G. Baranov, Hans Jürgen von Bardeleben, Fedor Jelezko, and Jörg Wrachtrup

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Spectroscopy of magnetic resonance has become an essential tool for scientists and engineers working in material growth and characterization, film deposition, defect detection, identifying donors and acceptors, and spin manipulation, as well as in medical and health-related fields. With the fast development of nanomaterials research in the past two decades, a book dedicated to research on magnetic resonance of nanomaterials such as this one is of interest to the scientific community.

This book consists of six chapters. The first two chapters lay out the theoretical framework of magnetic resonances, and the following chapters illustrate examples with experimental data and thorough technical discussions for readers to understand. The book provides fundamentals in theory to understand magnetic resonances (magnetic dipoles, magnetic resonance conditions, Bloch equations, g-factor, free induction decay, spin-echo); a comprehensive listing of experimental methods of electron paramagnetic resonance (EPR) spectroscopy; numerous examples of traditional EPR on intrinsic defects (vacancy, interstitial and antisite defects) of semiconductors (diamond, silicon, SiC, GaN, GaAs, and GaP); and more recent high-frequency EPR on wide-bandgap bulk, microscale, and nanoscale semiconductors (AgCl, AgBr, SiC, AlN, GaN, ZnO, InAs/GaAs, diamond).

The last chapter includes a brief discussion on the application of optically detected magnetic resonance (hence enhanced sensitivity in detecting spins) in single spin detection in diamond and SiC nanostructures or single organic molecules. This has gained increasing attention recently because they have possible applications in spintronics and quantum information processing.

What is unique about the book is that chapters 4–6 are developed around specific material systems and are straightforward, especially if the reader works in a particular material system (e.g., diamond or SiC) or a particular application of spectroscopy (e.g., electron nuclear double resonance or optically detected magnetic resonance).

Everyone in related fields (beginners and experts, experimentalists and theorists, and scientists and engineers) can benefit from this book. It includes just enough equations without spending too much time on details. Plenty of helpful figures and tables are provided throughout the book. Many up-to-date references are listed at the end of each chapter if readers want to dig into more detail. This would be a necessary exercise for beginners in order to fully understand the subject matters in the last three chapters. There are no homework problems as this is not really a textbook.

I highly recommend this book. Researchers who have just started working in the field would benefit from reading the whole book, and experienced researchers who want to know the most recent progress in the magnetic resonance spectroscopy of nanostructures could focus on one or two chapters (e.g., chapters 4 and 5).

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