This book describes the advanced developments in methodology and applications of NMR spectroscopy to life science and materials science. Experts who are leaders in the development of new methods and applications of life science and materials science have contributed an exciting range of topics that cover recent advances in structural determination and dynamic characterization of biological and material molecules, and development of novel NMR techniques, including resolution and sensitivity enhancement. First, this book particularly emphasizes the experimental details for new researchers to use NMR spectroscopy and also to pick up the potentials of NMR spectroscopy. Second, the book is designed for those who are involved in either developing the techniques or expanding the NMR application fields by applying them to specific samples. Third, the Nuclear Magnetic Resonance (NMR) Society of Japan has organized this book not only for NMR members of Japan but also for worldwide readers who are interested in using NMR spectroscopy extensively.

This book consists of two parts: methodology and application to life science and materials science. In Part I (Chaps. 1–9: Methodology), first, new concept of NMR experiment such as high pressure NMR and isotope-aided NMR methods are described. Second, advances in NMR data acquisition and processing methods are introduced. Third, advances in NMR hardware such as dynamic nuclear polarization (DNP), photoirradiation and microwave irradiation NMR spectroscopies are emphasized. Fourth, recently developed solid-state NMR spectroscopy under ultrafast magic angle spinning (MAS) is focused in this book. Fifth, dynamics of biological molecules using relaxation dispersion NMR spectroscopy is particularly emphasized. Sixth, structure-determination experiments of biological molecules utilizing paramagnetic lanthanide probe methods and solid-state NMR spectroscopy are particularly highlighted.

In Part II (Chaps. 10–22: Application to Life Science and Materials Science), advanced application to life science and materials science is described. First, as applications of solid-state NMR spectroscopy to materials science, studies on silk materials, polymer materials, functional materials and gaseous molecules in polymer materials are extensively described. Second, as applications of advanced NMR
techniques to life science, studies of natural products, glycoproteins and ribonucleic acid (RNA) are widely accounted. Third, metabolic profiling for small molecular complexity is introduced. Fourth, this book focuses on NMR studies of paramagnetic compounds. Fifth, NMR spectroscopy of quadrupole nuclei in organic compounds and inorganic materials is described. Sixth, advanced NMR spectroscopies are focused on characterization of protein–ligand interaction and determination of protein structure and dynamics.

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