Molecular Magnetism—New Magnetic Materials

Koichi Itoh and Minoru Kinoshita, eds.
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The terms molecular magnetism and molecular-based magnetism were coined in the late 1980s to summarize the research on the magnetism of molecules (and their arrangements) containing a number of spin centers. The present diversity of this field stems from its multiple motivations, which range from application-oriented research, for example, where magnetic hysteresis is a desirable property, to basic research in theoretical condensed-matter physics, on such topics as quantum tunneling and frustrated spin ordering.

This work by 33 contributors from Japan seeks to introduce "young scientists and graduates and advanced undergraduate students" to a particular subfield, namely, the magnetism of organic radical compounds. It must be stated first that the book's lack of uniformity in depth, organization, and topics—almost certainly caused by the large number of contributors—precludes its use as a textbook. In any case, basic knowledge of inorganic and especially organic chemistry is a necessary prerequisite for all readers.

As stated by the editors, the main portion of the book concentrates on the magnetism of organic radical compounds, and the primary idea behind this presentation is to show the effects that are responsible for spin orientations and interactions and that consequently could be used to design organic ferromagnets. The problem of understanding the intra- and intermolecular spin arrangement in organic radicals (presented in the chapters "Theory of Molecular Magnetism" and "Mechanism of the Spin Alignment of Molecular Magnetism") is approached by introducing a number of concepts from topology to *ab initio* calculations and is illustrated with many well-selected examples. A chapter on "Characterization of Molecular Magnetism" gives the basics, but it also provides a comprehensive and well-written description of pulsed electron paramagnetic resonance (EPR) techniques, especially one- and two-dimensional electron-spin transient nutation (ESTN) spectroscopy. The last chapter, titled "Molecular Design and Synthesis for Inorganic Molecular Magnetism," lists a number of transition-metal complex-based compounds and their properties, but the coverage of these inorganic molecule-based magnets remains superficial and unmotivated. Unfortunately, this chapter also contains a number of flaws and errors. The arbitrarily selected themes and example compounds appear somewhat dated (citations stop at 1997) and many prominent inorganic molecular magnets such as the Mn_{12} derivatives, Fe_n rings, the V_{15} cluster, and other single-molecule magnets are barely mentioned or not covered at all. Consequently, the interesting phenomena associated with such compounds, for example, quantum spin tunneling, are not mentioned, either.

For readers looking for an introduction into this field, this book could serve as a companion to established textbooks such as Olivier Kahn's *Molecular Magnetism* (VCH, 1993) or Roman Boca's *Theoretical Foundations of Molecular Magnetism* (Elsevier, 1999). Readers already established in molecular magnetism will find this volume to be useful if it is understood as a source of relevant citations and as a monograph that mainly concentrates on organic radicals and certain EPR techniques.

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