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Preface

Since the appearance of the seminal paper by Bleaney and Bowers in 1952 on the unusual magnetic and epr properties of copper acetate, which can be considered to be the quintessential spin coupled dinuclear coordination compound, the field of inorganic coordination chemistry, and latterly main group inorganic chemistry, and organic chemistry, has produced a plethora of examples of spin-coupled compounds. Synthetic ingenuity on the part of coordination chemists in particular has led to an explosion of examples of polynuclear systems with intricate connectivity between metal ions. These have widely varying magnetic properties, with examples of molecular antiferromagnets, ferromagnets, ferrimagnets, and molecular systems with properties of permanent molecular magnetization, which manifests itself above some critical temperature. A major driving force for the creation of 'novel' magnetic systems, which can be permanently and reversibly magnetized, stems from the belief that molecular based subunits will replace conventional magnetic 'data' recording media present typically in modern computer hardware. One major challenge in this area rests with the temperature at which molecular entities are capable of retaining their magnetization.

Understanding the magnetic exchange properties of such systems is fundamental to an appreciation of the factors which control magnetic behavior, and one's ability to perhaps identify rational and predictable routes to systems with specific magnetic outcomes. The use of theoretical models based on the spin vector summation approach of Kambe has proven invaluable in rationalizing the spin exchange properties of a variety of polynuclear assemblies, and has provided a foundation for the development of a handful of software packages to aid the community at large in dealing with simple and quite complex exchange problems (e.g. MAGPACK, MAGMUN, etc.). The seminal text written by Olivier Kahn, which appeared in 1993, blends a reasonable mix of theory and practicality to aid chemists and physicists in dealing with exchange problems from first principles. It has helped enormously to demystify the subject of magnetism and magnetic exchange in chemistry, and in the spirit of Olivier's own enthusiasm for 'molecular magnetism' has undoubtedly encouraged many chemists to embrace the challenge of understanding this difficult subject.

It is in this spirit of enthusiasm for molecular based magnetism, which Olivier professed constantly, that this special issue of Coordination Chemistry Reviews was conceived. It attempts to bring into focus the work of a number of prominent exponents in the area. Examples of heterocyclic and nitroxide radical systems highlight the importance of non-metallic spin bearing subunits as magnetic centers, and how their short- and long-range interactions lead to novel magnetic properties. The interaction of such spin centers with metal-based spin centers adds a further dimension to this area, with important examples of ferromagnetic interactions. Spin crossover properties have played a fundamental role in e.g. iron magnetochemistry, and the interplay of this behavior with other important physical attributes opens up new ways of controlling magnetic behavior. Polynuclear systems are featured with examples of magnetic chains, cages, wheels, and grids, and approaches to an understanding of their complex magnetic properties from a theoretical perspective are highlighted. Long-range magnetic interactions are analyzed and discussed in a series of tetrabromocuprate systems.

While bulk magnetic behavior represents the major focus of many magnetochemical studies, the examination of magnetic behavior at interfaces is less well documented. Metal cyanide thin film networks created at the air/water interface are discussed in this review issue, and their properties highlighted. Computational approaches to calculate spin density distributions in transition metal compounds are also included, focusing on spin delocalization and spin polarization mechanisms.

We hope that this collection of timely reviews will provide a stimulating platform for future studies in these important areas, and all contributors are thanked for their generous support of this issue.

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