

Book review

Transition Metal Oxides: Structure, Properties, and Synthesis of Ceramic Oxides
Second edition, edited by C.N.R. Rao and B. Raveau, published by Wiley–VCH, New York, 1998,
373 pp., ISBN 0-471-18971-5, Price US\$80.00 (hardback edition)

The appearance of a second edition only three years after the original work attests to the continuing extensive interest in the phenomena of high-temperature superconductivity in the copper oxides and of a colossal magnetoresistance in the manganese oxides with perovskite-related structures. Twenty-five years ago, interest in these oxides peaked over the phenomena of charge- and spin-density waves associated with a metal-insulator transition and the transport properties of mixed-valent systems. Fifty years ago, it was stimulated by the phenomena of ferroelectricity, the Verwey transition in Fe_3O_4 and metallic conductivity in Na_x/WO_3 , cooperative Jahn–Teller deformations, and magnetic-exchange interactions. The chemists have, in addition, been interested in methods of synthesis, single-crystal growth, phase equilibria, and the structural chemistry of the transition-metal oxides. The properties of more immediate interest to the chemist are their catalytic properties and their ability to conduct ions in electrolytes, in mixed electronic–ionic conductors, and in insertion-compound electrodes used as battery cathodes and electrochromics.

Rao and Raveau offer a descriptive text that presents in Part I, Structure (225 pp.), a well-illustrated catalogue of the structures encountered in stoichiometric and non-stoichiometric transition-metal oxides. This portion of the text provides a useful introduction to the beautiful complexity of the architectures of these oxides, but it gives little insight into why a given structure and composition is competitive with an alternative. Part II, Properties and Phenomena (90 pp.), emphasizes, in addition to ferroic transitions, phenomena associated with a transition from localized to itinerant electronic behavior such as high- T_c superconductivity, metal–insulator transitions, and the colossal magnetoresistance in the manganese oxides. This is a natural emphasis in view of the present intense activity in this field, but the task undertaken proves too ambitious. Although the text introduces the reader to some of the important concepts needed to understand the rich tapestry of phenomena that are encountered at this transition, closure is not made. Ionic transport and other topics of interest to electrochemists are totally ignored. The final Part III,

Preparation of Materials (36 pp.) summarizes several soft-chemical routes and techniques of single-crystal growth, topochemical and intercalation reactions, and high-pressure synthesis in addition to the conventional ceramic approach. In addition to calling attention to a large number of synthetic procedures, it provides references to the literature that should be useful.

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