Clays and Clay Minerals, Vol. 51, No. 2, 226–227, 2003.

BOOK REVIEWS

Micas: Crystal Chemistry and Metamorphic Petrology, edited by A. Mottana, F. Sassi, J.B. Thompson Jr and S. Guggenheim. *Reviews in Mineralogy and Geochemistry* **46,** 2002; 499 pp. [ISBN 0-939950-58-8]. Price $32 ($24 for CMS, MSA and GS members)

At first sight, a second book dedicated to micas in the *Reviews in Mineralogy* series might seem excessive. *Micas: Crystal Chemistry and Metamorphic Petrology* has its origins in an international meeting convened in Rome in 2000 by the Italian National Academy. While many of the presentations were published in a thematic issue of the *European Journal of Mineralogy* (2001), the plenary lectures were expanded, very extensively in some cases, to form this book. My initial scepticism was quickly dispelled by the presentation and editing of the book as I began to appreciate the level of detail that has been skillfully arranged in almost 500 pages of text. It is clear that 18 years has seen a considerable increase in our knowledge of this important group of minerals, and this addition to *Reviews in Mineralogy and Geochemistry* easily justifies itself.

The preface rightly reminds us that micas are amongst the more common minerals in the Earth's crust, forming an estimated 4.5% by volume. However, after a further reminder of how widespread the micas are in sedimentary, metamorphic and igneous rocks, I was dismayed to be told that micas 'form in the upper greenschist facies', implying that they are absent at lower grades. Happily for any clay mineralogists and low-grade metamorphic petrologists who are eager to acquire this book, chapter 11 corrects any misunderstanding.

By way of 12 chapters the reader is conducted through the mineralogy of micas from atoms (chapters 1 and 3), through crystals (chapters 4 and 5) to rocks (chapters 9, 10 and 11), and finally to the history of mica research. In many ways chapter 1 sets out the rationale for the book, starting with the structure and crystal chemistry of some 200 micas including new species (since 1984) and some synthetic varieties. It concludes with the dehydroxylation characteristics of micas, which are used to explore atomistic models and the origin of *trans*- and *cis*-vacant structures. The behavior of micas at high pressures and temperatures is explored in chapter 2, followed by a review of the structural features of micas in chapter 3, including a valuable description of the oblique-texture electron diffraction technique. By far the largest section, chapter 4, is devoted to polytypism and twinning, and here the 'magic' of trigonal symmetry and pseudosymmetry is first simplified and then elaborated. Some superb lattice fringe images are found in chapter 5, which reviews the most recent high-resolution transmission electron microscope techniques, particularly the application to polytypism and defect analysis.

The optical and Mössbauer spectroscopy of iron in micas is reviewed in chapter 6, while chapter 7 deals with the infrared spectroscopy of micas, but will disappoint clay mineralogists by the omission of illite and glauconite. A useful summary of X-ray absorption spectroscopy (XAS) methods is given in chapter 8, including extended X-ray extended absorption fine structures (EXAFS) and X-ray extended absorption near-edge structures (XANES) spectroscopy, and it also lists published XAS data on micas. Chapter 9 focuses on dioctahedral K-Na white mica found in metamorphic rocks, especially on their rock-forming properties and use for petrogenetic studies. Micas are considered in terms of mineral assemblages in pelitic schists in chapter 10. Here the concept of modal space is used to demonstrate changes in modal abundance of minerals as net-transfer reactions proceed. Micas in the realm of diagenesis and very low-grade metamorphism are considered in chapter 11, especially the concepts of illite crystallinity and reaction progress, and the techniques used in their evaluation. Finally, chapter 12 provides a fascinating history of the micas from the writings of Plinius, through the early crystallography of the 17th century to the present.

This is not bedtime reading – indeed browsing anywhere between the preface and the final chapter without a sound knowledge of sheet silicates could be unsettling. But if you need to delve deeply into the cryptic magic of the micas, this book is for you.

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Layered Double Hydroxides: Present and Future, edited by Vicente Rives. Nova Science Publishers, New York, 2001, ix + 439 pages. [ISBN: 1-59033-060-9]. Price $89.

The layered double hydroxides (LDH) are a diverse group of materials, well represented in nature but also readily synthesized in the laboratory. They are in general derived from divalent metal hydroxides by partial incorporation of a tervalent metal, leaving a

positive charge on the hydroxide sheets, which is balanced by the uptake of exchangeable anions; hence the alternative term 'anionic (anion exchanging) clays', while they are sometimes known as hydrotalcite-like materials, after the basic magnesium aluminum hydroxide carbonate, which is the most commonly encountered LDH mineral. The inorganic-chemistry community was remarkably slow to realize the ease with which these phases could be prepared in the laboratory, but the recent growth of interest in these materials, which are now the subject of more than 200 separate publications each year, has been dramatic.

Thus the present volume is both useful and timely. Indeed, in this reviewer's opinion, it belongs in the library of every institution where there is interest in the chemistry of clays or other inorganic materials prepared from solution, and on the shelf of every group actively engaged in research on LDH. Even in these days of computer-assisted literature searching, novice and expert alike can benefit from reviewing the selections offered by leaders in the field, and I can think of occasions when many hours would have been saved in my own research group if this book had been to hand.

The first and larger part of the book is devoted to synthesis, structure and characterization, while the second section, devoted to applications, covers the topics of decontamination, catalysis by LDH themselves and their calcination products, and also photochemical, medicinal, and environmental chemistry, the last of these with particular emphasis on the Fe(II)Fe(III) LDH, or green rusts. It should be noted, however, that the largest single commercial application (as fillers for plastics) is not covered. The names of the chapter authors will be familiar to all workers in the area, and the coverage is comprehensive and timely. The specific chapter topics are well chosen, and those involving the use of specialized techniques are prefaced by brief but useful overviews of the methods in question.

I do, of course, have a number of reservations, some involving layout and presentation, while others refer to specific details of content. Nothing is said about thermodynamics or quantitative solubility studies, although at least three groups have published in this area. Inevitably and appropriately, many pages are devoted to lists of references, with considerable duplication between the different chapters; a unified bibliography would have had advantages in terms of saved space, and, more importantly, saved time for the user. The space freed up in this way would then have been available for larger scale production of the micrographs which are too small, too poorly resolved, and, for my own taste, too few in number. A firmer editorial hand would have been useful in preventing repetition of familiar material in chapter introductions, while the appearance in one chapter of numerous detailed graphs derived from those authors' own accessible published work seems an unnecessary indulgence.

There are other, more interesting, deficiencies which I believe to reflect important facts about our state of knowledge, rather than any shortcoming of this publication. Almost nothing is said about the processes that control particle creation and growth, or the mechanisms that are are involved in ageing and post-treatment. The discussion of delamination is tantalizingly brief, and, again, unaccompanied by any discussion of the forces involved at the molecular level, although our limited ability to control this phenomenon is one of the major ways in which LDH research lags behind the study of phyllosilicate clays. Indeed, I am often asked by colleagues who work with these why delamination of LDH is so much more difficult to achieve; this book has not helped me find the answer.

One curious feature of LDH research is how little of it, compared with other areas, is taking place within the USA. I suspect that this is precisely because it has proved so difficult to make any headway on the fundamental issues of control of particle growth in morphology, at a time when published US materials research is dominated by the search for control of microstructure.

The title of the book refers to the 'present and future' of LDH. I would have liked to have seen a little more speculation as to what that future might be.

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