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BOOK REVIEW

Spectroscopic Methods in Mineralogy and Geology, F. C. Hawthorne, Editor. Reviews in Mineralogy, Vol. 18, Mineralogical Society of America, Washington, D.C., 1988. 698 + xvi pp., softbound, $18.00 (ISBN 0-939950-22-7).

From a chemical viewpoint all materials sciences are based on qualitative and quantitative analyses of the bulk and the surface. This requires typically a multi-technique approach, the choice of the techniques being dictated by the type of information one wants to obtain. Spectroscopic techniques are among the most popular techniques. It is therefore not surprising to see a large number of books that offer the basic principles of a subset of spectroscopic techniques and applications in a particular field of materials science, such as clays, zeolites, and heterogeneous catalysis. Besides such books, a large number of review papers in proceedings of conferences and in regular journals are also available. The readers, or at least this reviewer, are more or less saturated by this type of literature, and I was sceptical when asked to review volume 18 of the Reviews in Mineralogy series on Spectroscopic Methods in Mineralogy and Geology. My scepticism, however, quickly turned into satisfaction after reading the first three chapters: Introduction of Spectroscopic Methods; Symmetry, Group Theory, and Quantum Mechanics; and Spectrum-Fitting Methods. Most review books of this type lack such introductory chapters which put the reader on the right track before starting with the different techniques. These three chapters alone (98 pp.) make the book worthwhile to read.

A large number of techniques are discussed in this volume, which makes it a long book (698 pp.). They include infrared and Raman spectroscopy, with a separate chapter on vibrational spectroscopy of hydrous compounds; inelastic neutron scattering; optical spectroscopy; Mössbauer spectroscopy; nuclear magnetic resonance (discussed in two separate chapters, one on magic-angle spinning NMR and one on dynamic processes in mineralogy and geochemistry); X-ray absorption spectroscopy; electron paramagnetic resonance; auger electron and X-ray photoelectron spectroscopies; and luminescence, X-ray emission, and other types of spectroscopies (i.e., Rutherford backscattering and electron energy-loss spectroscopy). For each technique the following elements are discussed (1) the physical phenomena that form the basis of the technique; (2) qualitative and quantitative analysis; (3) instrumentation; (4) advantages and limitations of the technique; and (5) applications in the areas of mineralogy and geology. The emphasis of each chapter may differ, however, depending on the type of technique and the author(s), an inevitable consequence of a multi-authored book and of the broad range of techniques covered.

This reviewer was somewhat biased in his evaluation of the volume, because he is not an expert in all of these techniques; but then, such a reviewer probably does not exist. Each chapter of the volume is therefore not judged separately, rather the volume is reviewed here as a complete entity. According to the editor, the primary objective of the volume is instruction. He and his authors have succeeded in reaching that goal, to a large extent. In addition to the three introductory chapters, the chapters on Mössbauer Spectroscopy, MAS-NMR Auger Electron and X-ray Photoelectron Spectroscopies, and Luminescence, X-ray Emission and New Spectroscopics are excellent in this respect. I found the chapters on X-ray Absorption Spectroscopy and Electron Paramagnetic Resonance more difficult to read. In the last five chapters the number of (typing) errors is exceptionally low; however, the number of typing errors in chapter 9 on MAS-NMR is disturbingly large. In the first chapters (1–8), the number of typing errors is at an acceptable level, although some errors are particularly disturbing. For example, the upper table on page 51 gives the total character for $\sigma(yz)$ as $3 \times 1 = 1$, and on page 161 zero mass should be zero charge and λ should equal $h/\sqrt{zm}\cdot E$. In Figure 1 of chapter 14, it seems that the technique is spelled luminiscence instead of luminescence.

The editing is well-done; however, the books given on page 149 are not completely referenced. Table 1 of chapter 11 on EXAFS is hardly readable, and in the chapter on electron paramagnetic resonance, the commonly used symbol $g_\perp$ is replaced by $g_.$. On page 176, the legends of the abscissa and ordinate cannot be read with the normal human eye. In general, however, this is a highly instructive book, from which I have learned a lot.

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