THE INFRARED SPECTRA OF MINERALS

EDITED BY

V. C. FARMER

MINERALOGICAL SOCIETY

THE INFRARED SPECTRA OF MINERALS

MINERALOGICAL SOCIETY
MONOGRAPH 4

THE INFRARED SPECTRA OF MINERALS

EDITED BY
V. C. FARMER
Department of Spectrochemistry
The Macaulay Institute for Soil Research
Aberdeen

MINERALOGICAL SOCIETY
41 QUEEN'S GATE
LONDON SW7 5HR
1974

Published by the
MINERALOGICAL SOCIETY
with financial assistance from
THE ROYAL SOCIETY

ISBN 0 903056 05 4

Printed by Adlard & Son Ltd., at the Bartholomew Press,
Dorking, Surrey.

LIST OF CONTRIBUTORS

Dr Victor Colin Farmer, Department of Spectrochemistry, Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen, AB9 2QJ, Scotland.

Prof. Friedemann Freund, Mineralogisch-Petrographisches Institut, Universität Köln, 5000 Köln-1, Zülpicher Strasse 49, West Germany.

Dr William Pettit Griffith, Department of Chemistry, Imperial College of Science and Technology, South Kensington, London, SW7 2AY.

Prof. Armand Hadni, Institut de Physique, Faculté des Sciences, Université de Nancy, 2 Rue de la Craffe, Nancy 2, France.

Prof. Otto Henning, Sektion Baustoffverfahrenstechnik, Hochschule Fur Architektur und Bauwesen, Coudraystrasse 13, Postfach 136, DDR–53 Weimar.

Dr Adrian Nikolaevich Lazarev, Institut Khimii Silikatov im I.V. Grebenschikov, Acad. Sci. USSR, Leningrad V-164, Naberezhaja Makarova 2, U.S.S.R.

Dr Horst H. W. Moenke, VEB Carl Zeiss, Carl Zeiss Strasse 1, DDR–69 Jena.

Dr Sydney Parke, Department of Glass Technology, University of Sheffield, Elmfield, Northumberland Road, Sheffield, S10 2TZ.

Dr Sidney David Ross, Department of Chemistry, Chelsea College, University of London, Manresa Road, London, SW3 6LX.

Mr James Dennis Russell, Department of Spectrochemistry, Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen AB9 2QJ, Scotland.

Dr Yakov Isaakovich Ryskin, Institut Khimii im I.V. Grebenschikov, Acad. Sci. USSR, Leningrad V-164, Naberezhaja Makarova 2, U.S.S.R.

Dr Roger Guillaume Jean Strens, School of Physics, The University, Newcastle upon Tyne, NE1 7RU.

Prof. William Blaine White, Materials Research Laboratory and Department of Geosciences, The Pennsylvania State University, University Park, Pennsylvania 16802, U.S.A.

ACKNOWLEDGEMENTS

THE Mineralogical Society is greatly indebted to The Royal Society for an interest-free loan towards printing costs; and also to Beckman-RIIC Ltd. and Perkin-Elmer Ltd. for financial assistance during a period of national stringency.

Special thanks are due to the authors of the various chapters, whose diligence has brought the book to publication within four years of initiation.

The Editor is grateful to Dr R. L. Mitchell, Director of the Macaulay Institute for Soil Research, for permission to undertake this time-consuming task, and to the continuing support of his colleagues during its progress. He is particularly indebted to Mr J. D. Russell for assistance in evaluating manuscripts and in proof reading, and to Miss L. Gray for accurate and speedy secretarial assistance. Relevant parts of an index of mineral spectra maintained at the Macaulay Institute, and kept up to date by Mr A. R. Fraser, has been made available to the contributors.

Mr B. R. Young, Publications Manager of the Mineralogical Society, has been unfailingly helpful and encouraging, and has done much to streamline the production process. The printers, Adlard and Son Ltd., have made a substantial contribution to the accuracy and internal consistency of the text.

A number of publishers have kindly granted permission to reproduce figures and tables. These include G. Bell and Sons for Figures 4.6, 10.2, and 13.1, which first appeared in Sir Lawrence Bragg's *Atomic Structure of Minerals* published by Oxford University Press; Societé Française de Céramique for Figures 10.1 and 13.15; Académie Royale de Belgique for Figures 13.2, 13.3, 13.4; Silicates Industriels, A.S.B.L., for Figures 10.4 and 10.8; Microforms International Marketing Corporation for Figures 2.1, 10.6, 10.7, 15.1, 15.3, 15.4, 15.5, 15.16, 17.2 and 17.3; The National Bureau of Standards, U.S.A., for Figure 11.3; The National Research Council, U.S.A., for Figure 19.12; The Chemical Society for Figure 19.10; Akademische Verlagsgesellschaft for Figure 13.6; The American Chemical Society for Figure 2.2; The Clay Minerals Society for Figure 2.3; and The Mineralogical Society of America for Figure 15.2 and Table 15.1.

CONTENTS