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**Book Reviews**

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**Interfacial aspects of phase transformations.** Edited by B. MUTAFTSCHIEV. Pp. x + 708. Dordrecht: Reidel, 1982. Price Dfl 185.00, US \$79.00

This book is a collection of lectures presented at the NATO Advanced Study Institute on 'Interfacial Aspects of Phase Transformations', held in Erice (Sicily) in 1981. The Institute was the seventh course of the International School of Crystallography, established in the Center of Scientific Culture 'Ettore Majorana' in 1974.

This book consists of twenty-seven papers covering six basic areas: structure of interfaces, physisorption and chemisorption, nucleation, surface thermodynamics and kinetics, crystal growth and crystallization, and new observation techniques applied to crystallography. The reader will find in the first three chapters (Bauer, Gaspard, Mutaftschiev) descriptions of clean crystal surfaces, their structure, energy and thermodynamics, followed by a similar treatment of two-dimensional phases on foreign substrates (Gaspard, Domany). The consideration of the structure and behaviour of more complicated interfaces is contained in three further chapters (Bonissent, Franks, Gleiter). The next part is devoted to problems of interfacial kinetics. It begins with a general overview of elementary processes (Cole-Toigo) and

covers their principal applications in phase transformations: homogeneous nucleation (Katz), substrate nucleation and coalescence of small particles (Kern), and crystal growth (Rosenberger). In the next twelve chapters, the cases treated are: physisorption (Webb-Bruch), chemisorption (Bauer, Oudar), and crystal growth in the several practically important systems, vapor (Cadoret), melt (Sekerka), aqueous solutions (Simon), biological systems (Franks), non-aqueous solutions (Boistelle), electrocrystallization (Budevski) and recrystallization (Gleiter), together with two special topics, the action of impurities (Boistelle) and dissolution (Simon). Some experimental methods for studying morphology are presented in the last two chapters (Bedarida, Bethe).

As we know, a lot of physical phenomena such as dissolution, vaporization, crystal growth and crystallization as well as other traditional phase transformations occur at interfaces. These phenomena are governed by the structure, energy, thermodynamics and kinetics of the phase interface as well as by the heat and mass-transfer conditions which occur at and near the phase interface. This book emphasizes the common fundamentals in closely related areas to promote the interpenetration of the various disciplines. Hence, this book is an excellent research monograph of surface science and crystal growth.

Most of the articles are well written with a lucid style.

Scientists and students interested in the field will undoubtedly benefit in having access to the book. Most of the papers give extensive references to recent articles dealing with the topics and there is a brief subject index at the end of the book. The book will certainly be used extensively by research workers, teachers and postgraduates interested in the different fields of crystal growth and surface science. It does undoubtedly offer a very extensive range of expertise.

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**High-pressure research in geophysics. Advances in earth and planetary sciences 12.** Edited by S. AKIMOTO and M. H. MANGHANI. Pp. ix + 632. Tokyo: Center for Academic Publications Japan and Dordrecht–Boston–London: Reidel, 1982. Price Dfl 260.00, US\$113.00.

This book contains 45 papers submitted at the US–Japan Seminar held in January 1981 in Hakone (Japan) attended by 40 scientists from Japan, 21 from the United States and six from other countries.

The contributions were subdivided into seven sections: instrumentations and pressure calibration; elasticity, attenuation and rheology of the crust and upper mantle; mechanical properties and melting of the crust and upper mantle; geophysics and geochemistry of the mantle; high-pressure phase transformations and crystal chemistry; thermochemistry and crystal growth; shock-wave experiments.

Solving the problems which are important for our understanding of the interior of the earth has provided a strong impetus for the progressive development of super-high-pressure techniques. By the maximally achieved parameters and the standard of experimental research, geology often goes ahead of physics and chemistry in dealing with these problems.

Exceptionally good progress in instrumentation has been achieved by the creation of multi-anvil multi-stage presses and diamond-anvil cells; this is fairly well illustrated in this book.

S. Endo and E. Ito used sintered diamond anvils as the final stage of the multi-anvil apparatus which permitted them to measure the resistance of FeO, Al<sub>2</sub>O<sub>3</sub> and CaO up to 60–80 GPa (600–800 kbar). E. Ohtani and collaborators have increased the range of operating temperatures up to 2800 K, and studied the melting of fayalite, forsterite and pyrope up to 20 GPa.

The diamond-anvil cell was improved by the use of external heating, with measurements of temperature by the broadening of ruby luminescence lines (O. Shimamura *et al.*), by the use of conical slit and solid-state detector (T. Yagi & S. Akimoto), energy-dispersive diffraction (W. B. Holzapfel, W. May), and synchrotron radiation (E. Skelton), which made it possible to decrease the exposure time in X-ray

measurement by one–two orders of magnitude, and also by the development of a method for measuring the pressure–temperature by means of Au, Pt, and MgO standards (J. C. Jamieson *et al.*).

Owing to the techniques developed, it was possible to fix with fair accuracy the elastic constants for forsterite, *n*-H<sub>2</sub>, *n*-D<sub>2</sub> and their pressure derivatives by Brillouin scattering (W. A. Bassett *et al.*; H. Simizu *et al.*); it was also possible to show the isostructural nature of the phase conversion of Fe<sub>2</sub>O<sub>3</sub> at 55 GPa and its probable transition from high-spin to low-spin state, to show the change of structure from *B*<sub>1</sub> to *B*<sub>2</sub> type for CaO at 60 GPa (T. Yagi – S. Akimoto); to measure the thermochemical properties of the minerals stable at larger depths (H. Watanabe; A. Navrotsky *et al.*); to obtain some new *AX*<sub>2</sub>-type polymorph modifications and find out generalized data on their crystal structures (L. Ming & M. H. Manghani; L. Liu). Of special interest for geologists are the equilibria in the system MgO–FeO–SiO<sub>2</sub>, as based on the experimental data at 30–50 GPa, and petrologic mantle models (H. K. Mao *et al.*; E. Ito & H. Yamada; P. Shen *et al.*).

The concepts dealing with the mineral mantle composition may be diverse, as the dependence of the equilibrium assemblages on temperatures has so far been determined rather approximately and the formation of solid solutions with Al<sub>2</sub>O<sub>3</sub>, CaO and some other components may essentially change the entropy and phase volumes, resulting in their stability fields also becoming changed.

Experiments using the effect of shock waves on minerals make it possible to examine the temperature range up to about 3000 K which is unattainable by static runs; this has permitted the more accurate determination of the parameters of stishovite and Fe melting at pressures corresponding to the earth core boundary (T. Ahrens *et al.*; J. Brown & R. J. McQueen). Nine papers are devoted to a careful study of the mechanical and rheologic properties of rocks and minerals, kinetics of polymorphous transitions, and redox conditions existing at depth.

Some general problems of crystal chemistry such as the correlation between ion sizes and compression under pressure (C. T. Pevitt), use of interatomic potentials and molecular dynamics to calculate thermodynamic properties at polymorphous transitions, and equilibria in the melts are discussed (R. Jeanloz; Y. Matsui *et al.*). M. Wakatsuki & K. Ichinose, H. Kanda & O. Fukunaga report some very interesting data dealing with control of nucleation processes so as to grow large and rather perfect diamond crystals (up to 3 mm), and they give a description of their morphology.

Most of the contributions contained in this book will be interesting not only for those working in the field of geophysics, but also for a wide circle of crystal chemists, high-pressure technologists and specialists on crystal growth.

In the *Preface* to this book S. Akimoto & M. Manghani stress that the task of the editors was to maintain the high quality of the papers. One may note that this objective was fulfilled perfectly: all the work reported is at a high experimental and theoretical level and makes a valuable contribution to science and to high-pressure technology.

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