

BOOK REVIEW

Heinrich, W. and Abart, R. (Editors). *Mineral Reaction Kinetics: Microstructures, Textures, Chemical and Isotopic Signatures*. European Mineralogical Union (EMU) Notes in Mineralogy, Volume 16, EMU and The Mineralogical Society of Great Britain & Ireland, 2017, 651 pp. ISBN: 978-0903056-63-2.

ROCK microstructures hide important clues to our understanding the processes in the Earth's interior. Over the last decade, research on mineral reaction kinetics has been improved significantly due to advances in both analytical and computational techniques. This book provides an apt overview of the current state-of-the-art with examples from experiments, theoretical derivations and numerical modelling, and direct natural observations.

This book is number 16 in the EMU Notes in Mineralogy Series. It contains 17 chapters, written by relevant experts in the field, with a subject and author index at the end of the book. Each chapter includes separate reference lists.

The Introduction written by the book editors R. Abart and W. Heinrich provides a brief overview of the topic and introduces the book. Chapter 2 describes recent advances in experimental approaches on mineral reactions by R. Milke, W. Heinrich, L. Goetze and S. Schorr. The authors discuss the most critical questions such as the role of fluids or how rheology influences rim growth. S. Zaeferrer and G. Habler focus on the principles of scanning electron microscopy in Chapter 3. They introduce the most common indicators we can apply to geomaterials. Furthermore, they also provide an overview of the electron backscatter diffraction technique including indexing and orientation determination as well as advanced applications such as measurements of elastic and plastic strain fields. Chapter 4 (by R. Wirth) and Chapter 5 (by E. Deloule and N. Valle) focus on the applicability of high-resolution techniques – transmission electron microscopy and secondary ion mass spectrometry, respectively. In Chapter 6, C.G. Schroer introduces the application of X-ray microscopy techniques with chemical and structural contrast to geomaterials. If we want to quantify rock microstructures, we have many complexities to solve. Chapter 7 by J. Svoboda, F.D. Fischer and E. Kozeschnik

describes the thermodynamic extremal principle as a very versatile tool for modelling irreversible processes in such complex systems. The theoretical overview is accompanied by practical examples on grain growth and coarsening and solid-state precipitation. Chapter 8 by S. Jahn and X-Y. Sun is focused on atomic-scale numerical modelling. This field has gained the importance over the last decade due to advances in computational science. Along with a brief introduction to the approach, this Chapter brings practical examples on modelling crystal defects such as dislocations or phase and grain boundaries and self-diffusion. Chapters 9 and 10 by E. Petrishcheva and R. Abart introduce the basics of diffusion and the phenomenological treatment of interfaces, respectively. The following Chapter 11 by F. Gaidies closes this theoretical set of contributions by reviewing the fundamentals of the classical nucleation theory. F. Gaidies also introduces non-classical gradient-energy continuum approaches to nucleation and the phase-field method for microstructure evolution. Chapters 12 to 17 are dedicated to specific applications in geology and planetary research: Chapter 12 by S. Mollo and E. Hammer on magma crystallization; Chapter 13 by E. Ruiz-Agudo, C.V. Putnis and C. Rodríguez-Navarro on mineral-aqueous solution systems; Chapter 14 by F. Gaidies, R. Milke, W. Heinrich and R. Abart on metamorphic mineral reactions; Chapter 15 by G. Habler and T. Griffiths on crystallographic orientation relationships; Chapter 16 by O.I. Ulven and A. Malthe-Sørenssen on chemical and mechanical feedback during reaction-induced fracturing and finally Chapter 17 by J.A. Van Orman and M.J. Krawczynski on the role of stable and radiogenic isotopes in geomaterials.

The book is very well illustrated and written in a clear way. The reader is guided from basic methods to advanced techniques and quantification approaches that are now available for geomaterials. The book is aimed for young researchers, however, I recommend it to anyone who is in the mineral reaction kinetics 'business' as a great source of inspiration!

L. TAJČMANOVÁ

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