PREFACE

Every solid substance, irrespective of its size, is bounded by some sort of surfaces. The topographic nature of these surfaces is determined by the environment in which a particular solid substance exists during its lifetime. For example, the general landscape of the Earth in Europe differs enormously from that in Asia or in Africa due to differences in climatic conditions in these continents. While the desert and thorny bushes in the Sahara of Africa are due to the dry climate and relatively high temperature there, the wet climate and low temperatures of Europe is responsible for the terrains and forests containing tall trees with large thorn-free leaves. Other factors connected with the difference in the composition of the Earth from one region to another also contributes to the difference in the landscape of the planet. Presence of volcanos which yield a panorama completely different in the territory of Chile from that in the neighbouring Argentina is an example of this type.

Situation in the case of smaller objects is similar to that in the above example. In the case of crystalline solids, the panoramic view of their surfaces is different because of the varied environmental and structural (i.e. compositional and crystallographic) conditions. Depending on these conditions, the surfaces of crystalline solids show a variety of as diverse structures as spiral hillocks, depressions and cracks formed as a result of growth, dissolution and mechanical deformation, respectively. These diverse structures are given the general name of *surface morphology*, *surface micromorphology* or *surface microtopography* of crystals. The former two terms are usually used in the current literature [1] while the last term has been used in the works published by the school of Tolansky [2]. In the metallurgy literature, the term *microstructure* is usually employed [1].

The subject of micromorphology covers as-grown, etched, abraded and lapped, and fractured surfaces of single and polycrystalline solids, and glasses of as diverse substances as insulators, semiconductors, metals and polymers. Two relatively old books by Verma [3] and by Dekeyser and Amelinckx [4], and a recent review article by Sunagawa and Bennema [5] deal mainly with the origin and morphology of growth spirals, while the articles by Enckevort [6] and Sangwal [7] describe some observations of the surface morphology of solution-grown crystals. Authoritative treatments on the micromorphology of etched surfaces of crystals and minerals [8-11] and of fractured surfaces of different types of materials [12,13] are available. However, the literature on surface morphology is increasingly being published every year in various journals, and at present not only a nonspecialist or a beginner but also a specialist finds it difficult to have an overall picture of the subject due to absence of a reference book. The present monograph is intended to fill this gap.

The idea of writing the present monograph was conceived during 1985-6 when the first author was actively engaged in the study of the growth morphology of bulk single crystals. The original version of the monograph was planned to cover the micromorphology of as-grown, etched and evaporated surfaces of bulk single crystals. Then it was felt that this could easily be done in about 200 pages, including a synthetic survey of the areas and photographic illustrations. With these concepts still in the state of flux, the publishers (Trans Tech) were approached. The publishers warmly agreed to undertake the publication of the monograph. In view of various commitments of the first author, the tentative time of the completion of the manuscript was estimated to be the beginning of 1990. However, since then the contents of the book constantly underwent changes in order to widen the scope of the book from the standpoint of applied aspects of surface morphology, especially, in industry and mineralogy. At one stage it turned out that the subject matter was too large to be handled by one author. During this period when the second author offered to join the project, realization of the manuscript appeared possible. The monograph in its present form is a result of this collaboration between the authors on one hand and the publishers on the other.

The monograph describes and discusses general aspects of various types of the surface morphology of crystalline solids in the form of bulk crystals and deposited layers. Emphasis has been laid on tracing the origin of a surface structure in terms of current theoretical background. The contents of the book can roughly be divided into four parts. The first part is introductory in nature, where brief accounts of the nature of surfaces and methods of their observations (chapter 1), and the mechanism of growth and development of crystals (chapter 2) are given. The second part deals with various types of morphologies related with processes of growth (chapters 3 and 4), vaporization (chapter 5) and dissolution (chapter 6), the generation of defects during growth in the presence of impurities (chapter 7) and microstructures of alloys (chapter 7). The surface morphologies associated with cleavage, deformation and surface-preparation processes (chapter 8) are described in the third part. The last part deals with the morphology of organic molecular crystals and minerals (chapter 9).

During the writing of the book, every effort has been made to make it self-contained so that even a nonexpert will find the treatment of different phenomena clear and concise. To achieve this goal, chapter 2 on the mechanisms of growth and development of crystals (which are essential for understanding the surface morphology described in several latter chapters) is included, and the description of the phenomena is frequently supplimented by suitable photographic illustrations selected from the published literature. No sound knowledge or background of specialization in solid state sciences is required to understand the contents of the book.

The monograph is addressed to a wide range of readers, including scientific workers, teachers as well as students in the general areas of crystal growth and materials science, who are interested in understanding elementary processes involved in surface morphology and in characterising crystalline products by microscopic techniques.

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In every case the original sources of the figures reproduced in the monograph are indicated in their captions.

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