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Growth of Crystals

Volume 16

Edited by

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PREFACE

Papers from the Sixth All-Union Conference on Growth of Crystals comprise Volume 16 of this series. The articles were chosen with a view to more fully elucidate the basic problems of crystal growth as reflected in domestic and foreign reviews and in original studies. This volume consists of six parts.

Part I is devoted to mechanisms of crystal growth that are important for production of materials with given properties. This part examines the temporal evolution of an inhomogeneous state and the array of semicellular and eutectic structures during microstructure formation, the effect of impurity on the nonequilibrium vacancy concentration in a growing crystal, and the role of soluble and insoluble impurities in the birth and growth of crystals.

Part II deals with the synthesis and electrophysical properties of novel solid electrolytes that are promising for practical use, analysis and correlation of the large amount of data on growth by the Bridgman—Stockbarger method of single crystals of fluorite phases far from stoichiometry, and the hydrothermal chemistry and growth of hexagonal germanium dioxide.

Crystallization of films is of great importance in microelectronics. Part III gives a review of production methods of layers by electroliquid epitaxy and a discussion of questions on the epitaxy of semiconductors and metallic and dielectric films from molecular beams, the analytical methods used, and the properties of the films that are formed. Relations between growth conditions, structure, and cathodoluminescence of ZnSe on GaAs are studied. Kinetic relationships during gallium arsenide surface doping using gas-phase epitaxy are examined. Finally, results on photostimulated growth of doped PbTe are analyzed.

Crystallization of biological substances is treated in Part IV. Efforts in this direction have recently been accelerated. Conversion of biological molecules into the crystalline state is necessary for structural studies. The results obtained are then used in genetic engineering, medicine, pharmacology, biosynthesis, and other areas. Purification methods of the starting compounds can be applied to the crystallization of other organic and inorganic materials from solution. We hope to draw the attention of theoreticians to the mechanisms of formation of crystals composed of very large molecules.

The development of experimental methods for studying crystallization processes is dealt with in Part V. These include an investigation of melt structure and crystallization processes of various substances at high temperature using combined light scattering and direct observation of changes in acoustic emission of the actual crystal structure during growth from the melt. A review of contemporary electron-microscopic methods as applied to defect structure of semiconductors is also given.

The difficulties of direct scrutiny of crystallization processes are well known. Therefore, mathematical modeling methods are very effective for simulation of these processes. Part VI includes a review of mathematical modeling of crystallization from the melt, liquid- and gas-phase epitaxy, and simulation of melt hydrodynamics during Bridgman crystallization with accelerated crucible rotation. The influence of electromagnetic methods on hydrodynamics and heat and mass transfer in crystals grown from the melt is discussed.

We are indebted to coworkers S. N. Ryadnov, D. D. Perlov, and M. Yu. Muromskii of the Institute of Crystallography, Academy of Sciences of the USSR, for their help in preparing this volume.

Kh. S. Bagdasarov

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