

Preface

The properties of interfaces such as grain boundaries and interphase boundaries are entirely different from those of the bulk phase. The difference, involving both chemical composition and structure, is caused by adsorption and segregation. Accordingly, interface transport processes and related phenomena should be considered along with local properties of the interface region.

Interface processes play an important role in processing of ceramics, standardization of catalysts, oxidation of metals and preparation of electronic materials. In many cases interfaces may entirely control the material properties. This is why there has been an increasing interest in studies of interface properties of materials and interface phenomena. There is an increasing demand from engineering-related disciplines such as science of ceramics, corrosion, catalysis and sensorics to understand interface properties and related properties.

The purpose of the present volume is to overview the state of the art on interface segregation in solids and the effect of segregation on material properties. The volume also considers elementary transport processes within the interface (boundary) layer of ionic solids and the effect of segregation-induced concentration gradients on gas/solid kinetics.

The first chapter, by J. Cabane and F. Cabane, presents an extensive description on the thermodynamics of surface and grain boundary segregation in both metallic and non-metallic solids. This paper also considers experimental approaches and experimental data on segregation and practical aspects of segregation in solids.

Formalisation of kinetics of both adsorption and segregation at gas/solid interfaces is the subject of the second chapter. The paper considers governing kinetic equations and gives their approximate solutions.

The paper of Moya et al. is focused on the grain boundary transport kinetics in ionic solids of nonstoichiometric compounds. Specific approaches to study grain boundary diffusion in metals on the one hand and in ionic crystals of nonstoichiometric compounds on the other hand are considered.

The fourth paper considers the effect of interfaces on gas/solid equilibration processes involving the transport of defects across segregation-induced electric fields in the interface layer.

The paper of Grajewski and Fromm gives an overview on elementary processes at the gas/solid interface which occur during oxidation of metals. The paper considers several models of transport processes of defects in the interface layer.

The last chapter, by Yamawaki and Yamaguchi, is devoted to an applied aspect of segregation in nuclear engineering. The paper considers the effect of segregation-induced surface composition on the kinetics of hydrogen transport in metallic membranes of fusion reactors.

This volume is addressed to materials scientists and engineers working in the field of ceramics, corrosion, sensorics and catalysis. The book may also be recommended as a textbook for students in the field of materials science and surface science.

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