

Preface

Epitaxy—the growth of a crystalline layer on a crystalline substrate—represents the basis for the fabrication of semiconductor heterostructures and devices. Textbooks on semiconductor physics and devices usually describe the design a heterostructure and subsequently measured data of a respective realization. The chain between these end points requires to solve many basic problems related to physics and technology. Such steps are generally described in specialized literature focusing on diverse aspects. Students and researchers starting in the field need to study papers and books on quite specific problems in a wide field. This textbook attempts to bridge the gap between well-established books on semiconductor physics on one side and texts on completed heterostructures like semiconductor devices on the other.

The book is based on a one-semester course held at Technical University of Berlin for undergraduate and graduate students in physics and engineering physics. It is primarily addressed to the non-specialist with some basic knowledge in solid state and semiconductor physics. The field of epitaxy is rapidly evolving and includes many materials and growth techniques. The text therefore focuses on basics and important aspects of epitaxy, emphasizing particularly the physical principles. Problems are illustrated for important semiconductors with zincblende and wurtzite structure.

The subject matter first covers properties of heterostructures. Structural aspects implying elasticity and strain relaxation by dislocations are addressed as well as electronic properties including band alignment and electronic states in low-dimensional structures. Then the thermodynamics and kinetics of epitaxial layer growth are considered, introducing the driving force of crystallization and paying special attention to nucleation and surface structures. Instructive examples are given for self-organized growth of quantum dots and wires. Afterwards aspects of doping, diffusion, and contacts are discussed. Eventually the most important methods used for epitaxial growth are introduced: metalorganic vapor-phase epitaxy, molecular-beam epitaxy, and liquid-phase epitaxy.

I am grateful to my students, who consistently engaged me in discussions about fundamentals of epitaxy and stimulated an active motivation to write this book. Our librarian Mrs I. Langenscheidt-Martens was always an invaluable help for

finding references difficult to retrieve. I am also indebted to A. Krost for critical manuscript reading, and I appreciated the cooperation with C. Ascheron, Springer Science+Business Media.

Berlin
July 2012

Udo W. Pohl



<http://www.springer.com/978-3-642-32969-2>

Epitaxy of Semiconductors
Introduction to Physical Principles
Pohl, U.W.
2013, XIV, 325 p., Hardcover
ISBN: 978-3-642-32969-2