Preface

Silicon carbide (SiC) has established itself as one of the most high-performance semiconductor materials for next-generation power electronics devices. Its exceptional properties, including a wide bandgap, high critical electric field, superior thermal conductivity, and chemical stability, enable the creation of electronic components that also operate efficiently under extreme conditions. As SiC-based technologies continue to expand in electric vehicles, renewable energy systems, aerospace, and industrial power conversion, the quality and structural integrity of SiC crystals and epitaxial layers have become matters of paramount importance.

The performance and reliability of SiC devices are strongly influenced by crystallographic imperfections introduced during bulk crystal growth and epitaxial deposition. These include micropipes, threading screw and edge dislocations, basal plane dislocations, point defects, inclusions, voids, and surface-related imperfections, etc. Each of these defects can affect electrical characteristics, reduce the breakdown voltage, increase leakage currents, and limit the long-term stability of the final device.

This special edition is devoted to the identification, characterisation, and understanding of the effect of these critical imperfections. Emphasis is placed on advanced analytical techniques that provide essential insight into the origin, distribution, and evolution of defects, enabling continuous improvement in crystal growth processes and epitaxial technologies.

This publication aims to provide researchers and engineers with a deeper understanding of defect formation and characterisation, which is fundamental to achieving the material perfection required for the creation of reliable and efficient SiC-based electronic devices.