Preface

Silicon carbide (SiC) is one of the most strategically important semiconductor materials for modern power electronics, owing to its unique properties that enable highly efficient devices for electric vehicles, renewable energy systems, industrial power conversion, and aerospace applications. But at the same time, the exceptional hardness and brittleness of SiC present significant challenges in substrate preparation and wafer processing, where achieving high accuracy and minimal surface damage is essential for device performance and manufacturing yield.

This special edition focuses on scientific principles and the technologies that underpin the preparation and processing of SiC wafers. The technological operations involved in transforming a bulk SiC crystal into a device-ready substrate, including laser slicing, precision grinding, fixed-abrasive lapping, plasma chemical vaporisation machining, and wafer dicing, are described. Particular attention is given to crack propagation, thickness variation, and the generation of subsurface damage, as these factors strongly influence wafer flatness, structural integrity, and subsequent epitaxial growth.

The defect-related phenomena, such as basal plane dislocations and their interactions with mechanical and thermal processing steps, are also examined. Surface conditioning and material removal techniques, including wet etching, electrochemical etching, and high-temperature oxidation in vertical furnaces are also presented.

Emerging approaches to wafer recycling and water-jet-guided laser processing are discussed as innovative strategies to reduce material loss and enhance manufacturing efficiency.

We hope that the information presented in this edition will contribute to continued advances in SiC substrate manufacturing and support the development of the next generation of high-performance electronic devices.