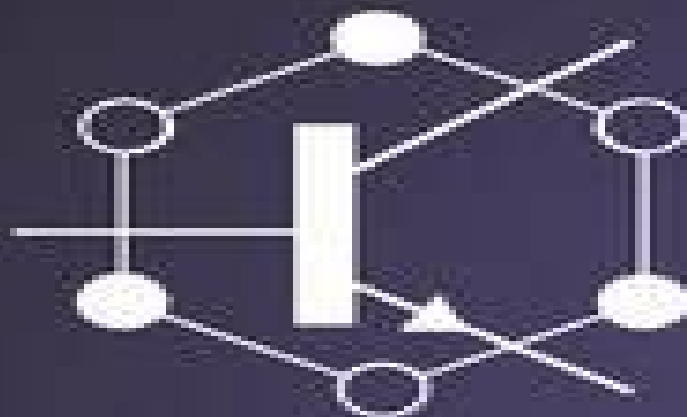


EMIS PROCESSING SERIES 2

# PROCESS TECHNOLOGY FOR SILICON CARBIDE DEVICES



Edited by  
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# Process Technology For Silicon Carbide Devices

**Tsunenobu Kimoto, James A. Cooper**



## **Process Technology For Silicon Carbide Devices:**

*Process Technology for Silicon Carbide Devices* Carl-Mikael Zetterling, 2002 This book explains why SiC is so useful in electronics gives clear guidance on the various processing steps growth doping etching contact formation dielectrics etc and describes how these are integrated in device manufacture      **Advanced Silicon Carbide Devices and Processing** Stephen Sadow, Francesco La Via, 2015-09-17 Since the production of the first commercially available blue LED in the late 1980s silicon carbide technology has grown into a billion dollar industry world wide in the area of solid state lighting and power electronics With this in mind we organized this book to bring to the attention of those well versed in SiC technology some new developments in the field with a particular emphasis on particularly promising technologies such as SiC based solar cells and optoelectronics We have balanced this with the more traditional subjects such as power electronics and some new developments in the improvement of the MOS system for SiC MOSFETs Given the importance of advanced microsystems and sensors based on SiC we also included a review on 3C SiC for both microsystem and electronic applications      **Physics and Technology of Silicon Carbide Devices** Yasuto Hijikata, 2012-10-16 Recently some SiC power devices such as Schottky barrier diodes SBDs metal oxide semiconductor field effect transistors MOSFETs junction FETs JFETs and their integrated modules have come onto the market However to stably supply them and reduce their cost further improvements for material characterizations and those for device processing are still necessary This book abundantly describes recent technologies on manufacturing processing characterization modeling and so on for SiC devices In particular for explanation of technologies I was always careful to argue physics underlying the technologies as much as possible If this book could be a little helpful to progress of SiC devices it will be my unexpected happiness      **Advancing Silicon Carbide Electronics Technology I** Konstantinos Zekentes, 2018-09-25 The rapidly advancing Silicon Carbide technology has a great potential in high temperature and high frequency electronics High thermal stability and outstanding chemical inertness make SiC an excellent material for high power low loss semiconductor devices The present volume presents the state of the art of SiC device fabrication and characterization Topics covered include SiC surface cleaning and etching techniques electrical characterization methods and processing of ohmic contacts to silicon carbide analysis of contact resistivity dependence on material properties limitations and accuracy of contact resistivity measurements ohmic contact fabrication and test structure design overview of different metallization schemes and processing technologies thermal stability of ohmic contacts to SiC their protection and compatibility with device processing Schottky contacts to SiC Schottky barrier formation Schottky barrier inhomogeneity in SiC materials technology and design of 4H SiC Schottky and Junction Barrier Schottky diodes Si SiC heterojunction diodes applications of SiC Schottky diodes in power electronics and temperature light sensors high power SiC unipolar and bipolar switching devices different types of SiC devices including material and technology constraints on device performance applications in the area of metal contacts to silicon carbide status and prospects of SiC power devices

Advancing Silicon Carbide Electronics Technology II Konstantinos Zekentes, Konstantin Vasilevskiy, 2020-03-15 The book presents an in depth review and analysis of Silicon Carbide device processing The main topics are 1 Silicon Carbide Discovery Properties and Technology 2 Processing and Application of Dielectrics in Silicon Carbide Devices 3 Doping by Ion Implantation 4 Plasma Etching and 5 Fabrication of Silicon Carbide Nanostructures and Related Devices The book is also suited as supplementary textbook for graduate courses Keywords Silicon Carbide SiC Technology Processing Semiconductor Devices Material Properties Polytypism Thermal Oxidation Post Oxidation Annealing Surface Passivation Dielectric Deposition Field Effect Mobility Ion Implantation Post Implantation Annealing Channeling Surface Roughness Dry Etching Plasma Etching Ion Etching Sputtering Chemical Etching Plasma Chemistry Micromasking Microtrenching Nanocrystal Nanowire Nanotube Nanopillar Nanoelectromechanical Systems NEMS Low Power Semiconductor Devices and Processes for Emerging Applications in Communications, Computing, and Sensing Sumeet Walia, 2018-08-06 The book addresses the need to investigate new approaches to lower energy requirement in multiple application areas and serves as a guide into emerging circuit technologies It explores revolutionary device concepts sensors and associated circuits and architectures that will greatly extend the practical engineering limits of energy efficient computation The book responds to the need to develop disruptive new system architectures and semiconductor processes aimed at achieving the highest level of computational energy efficiency for general purpose computing systems Discusses unique technologies and material only available in specialized journal and conferences Covers emerging materials and device structures such as ultra low power technologies nanoelectronics and microsystem manufacturing Explores semiconductor processing and manufacturing device design and performance Contains practical applications in the engineering field as well as graduate studies Written by international experts from both academia and industry **Power Microelectronics: Device And Process Technologies (Second Edition)** Yung Chii Liang, Ganesh S Samudra, Chih-fang Huang, 2017-03-14 This is an excellent reference book for graduates or undergraduates studying semiconductor technology or for working professionals who need a reference for detailed theory and working knowledge of processes in the field of power semiconductor devices IEEE Electrical Insulation Magazine This descriptive textbook provides a clear look at the theories and process technologies necessary for understanding the modern power semiconductor devices i e from the fundamentals of p n junction electrostatics unipolar MOSFET and superjunction structures bipolar IGBT to the most recent wide bandgap SiC and GaN devices It also covers their associated semiconductor process technologies Real examples based on actual fabricated devices with the process steps described in clear detail are especially useful This book is suitable for university courses on power semiconductor or power electronic devices Device designers and researchers will also find this book a good reference in their work especially for those focusing on the advanced device development and design aspects *Modern Silicon Carbide Power Devices* B Jayant Baliga, 2023-09-18 Silicon Carbide power devices are being increasingly adopted for many applications such as electric

vehicles and charging stations There is a large demand for a resource to learn and understand the basic physics of operation of these devices to create engineers with in depth knowledge about them This unique compendium provides a comprehensive design guide for Silicon Carbide power devices It systematically describes the device structures and analytical models for computing their characteristics The device structures included are the Schottky diode JBS rectifier power MOSFET JBSFET IGBT and BiDFET Unique structures that address achieving excellent voltage blocking and on resistance are emphasized This useful textbook and reference innovations for achieving superior high frequency operation and highlights manufacturing technology for the devices The book will benefit professionals academics researchers and graduate students in the fields of electrical and electronic engineering circuits and systems semiconductors and energy studies

**Fundamentals of Silicon Carbide Technology** Tsunenobu Kimoto, James A. Cooper, 2014-09-23 A comprehensive introduction and up to date reference to SiC power semiconductor devices covering topics from material properties to applications Based on a number of breakthroughs in SiC material science and fabrication technology in the 1980s and 1990s the first SiC Schottky barrier diodes SBDs were released as commercial products in 2001 The SiC SBD market has grown significantly since that time and SBDs are now used in a variety of power systems particularly switch mode power supplies and motor controls SiC power MOSFETs entered commercial production in 2011 providing rugged high efficiency switches for high frequency power systems In this wide ranging book the authors draw on their considerable experience to present both an introduction to SiC materials devices and applications and an in depth reference for scientists and engineers working in this fast moving field Fundamentals of Silicon Carbide Technology covers basic properties of SiC materials processing technology theory and analysis of practical devices and an overview of the most important systems applications Specifically included are A complete discussion of SiC material properties bulk crystal growth epitaxial growth device fabrication technology and characterization techniques Device physics and operating equations for Schottky diodes pin diodes JBS MPS diodes JFETs MOSFETs BJTs IGBTs and thyristors A survey of power electronics applications including switch mode power supplies motor drives power converters for electric vehicles and converters for renewable energy sources Coverage of special applications including microwave devices high temperature electronics and rugged sensors Fully illustrated throughout the text is written by recognized experts with over 45 years of combined experience in SiC research and development This book is intended for graduate students and researchers in crystal growth material science and semiconductor device technology The book is also useful for design engineers application engineers and product managers in areas such as power supplies converter and inverter design electric vehicle technology high temperature electronics sensors and smart grid technology

**Silicon Carbide Power Devices** B Jayant Baliga, 2006-01-05 Power semiconductor devices are widely used for the control and management of electrical energy The improving performance of power devices has enabled cost reductions and efficiency increases resulting in lower fossil fuel usage and less environmental pollution This book provides the first cohesive treatment

of the physics and design of silicon carbide power devices with an emphasis on unipolar structures It uses the results of extensive numerical simulations to elucidate the operating principles of these important devices

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