

# Gaas And Related Materials Bulk Semiconducting And Superlattice Properties

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this book presents progress in device processing and materials characterization of the wide bandgap semiconductor gallium nitride gan and related materials for power electronics applications the content of the book is based on the output of multiple well defined and

actively managed programs from the u s department of energy s advanced research projects agency energy arpa e the material is organized into eight parts with a total of 28 chapters contributed from invited experts that were part of the arpa e programs along with chapters from a few select experts from around the world who are actively engaged in gan and related wbg semiconductor research and development the book includes an overview of gan power electronic devices and systems and a comprehensive review of the key vertical device processing challenges part i detailed descriptions of bulk gan substrate technology part ii discussions of the challenges in gan epitaxial growth and processing part iii an in depth examination of approaches and challenges in gan selective area p type doping with an eye towards mechanistic understanding part iv an overview of innovative material characterization techniques developed to understand the device processing challenges part v an analysis of the fundamental materials properties of gan in relation to its use in power electronics part vi a discussion of related earlier stage nitride wide bandgap materials development and application in power electronics and other applications part vii and concludes with a forward looking discussion of the areas that still need research and development to push the limits of power electronics to utilize wide bandgap semiconductors along with potential high impact application areas part viii this book is intended to be an essential reference for anyone working in either basic research or advanced development of vertical architecture gan power electronics and technologies it is anticipated this book will become a go to reference for any scientist and engineer working in any nitride semiconductor material seeking an updated coverage of the state of the art processing and characterization techniques that will push gan know how to new materials and device frontiers

selected peer reviewed extended articles based on abstracts presented at the 20th international conference on silicon carbide and related materials icscrm 2023 aggregated book

this book covers the various material properties of bulk gaas and related materials and aspects of the physics of artificial semiconductor microstructures such as quantum wells and superlattices made of these materials a complete set of the material properties are considered in this book they are structural properties thermal properties elastic and lattice vibronic properties collective effects and some response characteristics electronic energy band structure and consequences optical elasto optic and electro optic properties and carrier transport properties this book attempts to summarize in graphical and tabular forms most of the important theoretical and experimental results on these material properties it contains a large number of references useful for further study timely topics are discussed as well this book will be of interest to graduate students scientists and engineers working on semiconductors

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this two volume set documents the present understanding of many topics of interest such as the growth of bulk crystals the growth of epitaxial layers theoretical modelling the characterization of as grown material the development of suitable processes and of electronic devices which can operate under extreme conditions and exhibit outstanding properties part 1 1 sic bulk growth 2 sic epitaxy 2 1 homoepitaxial growth 2 2 heteroepitaxial growth 3 theory 4 characterisation of sic 4 1 surfaces and interfaces 4 2 structural characterisation 4 3 optical characterisation 4 4 electrical characterisation 4 5 magnetic resonance characterisation 4 6 thermal and mechanical properties 5 measurement techniques part 2 6 processing of sic 6 1 doping and implantation 6 2 contacts and etching 6 3 dielectrics 6 4 micromachining 7 sic devices 7 1 surveys 7 2 unipolar devices 7 3 bipolar devices 7 4 sensors 8 growth of iii nitrides 9 characterisation of iii nitrides 9 1 structural characterisation 9 2 optical characterisation 9 3 electrical characterisation 10 processing of iii nitrides 11 iii nitride devices 12 related materials

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