edited by Anthony H. W. Choi

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Preface

An optical microcavity constitutes an integral part of a laser diode, confining light within an optical structure to establish optical resonances. At present, edge-emitting and vertical-cavity surface-emitting lasers are the most common types of laser diodes in the market, both of which are based on Fabry–Pérot cavities. However, novel forms of laser structures, based on alternative modes of optical confinement such as whispering-gallery modes and photonic bandgaps have been demonstrated in recent years, allowing light to be confined within smaller dimensions with high finesse.

Apart from different mechanisms of optical confinement, laser diodes based on different material systems give rise to devices operating at different wavelengths for different applications. For instance, the short-wavelength violet laser diodes based on the III-nitrides have been widely used for high-density optical storage in blu-ray players, while long-wavelength As-based infrared (IR) laser diodes are deployed in optical communication networks.

The chapters in this book cover a comprehensive range of topics pertaining to resonance in optical cavities by leading researchers in the field. Subjects include theory, design, simulation, fabrication, and characterization of micrometer and nanometer scale structures and devices that support cavity resonance via various mechanisms such as Fabry–Pérot, whispering gallery, photonic bandgap, and plasmonic modes. Optical cavities resonating from UV to IR wavelengths based on prominent III–V material systems, including nitrides of Al, In, and Ga; ZnO; and GaAs, are covered in this book.

The book begins with a comprehensive review of photonic crystal microcavities and microlasers, followed by a discussion on the simulation of planar photonic resonators. Chapters 3 to 10 pertain to optical cavities based on the III-nitride material system, including that of UV lasers; nitride microdisk cavities grown on Si substrate; MOCVD-grown nitride distributed Bragg reflectors; photonic crystal light-emitting diodes (LEDs); nanostructures in GaN-Si materials; light-coupling to surface plasmons; nanosphere-

patterned microcavities; and epitaxial lift-off of GaN thin films. Chapters 11 and 12 deal with optical microvacities based on GaAs and ZnO, respectively, while Chapter 13 analyzes nanoscale ring lasers.

It was a privilege to take responsibility for putting together this book, with the honor to invite distinguished researchers in field to contribute their expertise and insights in this intriguing technology. I would like to express my immense gratitude to all the contributors of the book. Without their kind and strong support, the project would not have been accomplished.

Anthony H. W. Choi
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