

Preface

Electro-optical (EO) infrared (IR) imaging is distinguished by such characteristics as operating passively and possessing high spatial resolution as compared to active microwave imaging technology. IR detectors for military usage were first developed in WW2, but most significant recent development occurred after the demonstration of focal plane arrays (FPAs) in the 1970s. Nowadays, the technology of IR FPAs has become one of the most essential elements of information-based military systems. As driven by military and civil needs, FPA technology is continuously evolving to ever stronger capabilities in long range sensitivity, high speed, environmental and weather compatibility, compactness in volume, low-power consumption, and cost.

In general, advanced FPAs can be a comprehensive concept. They may work in spectral ranges of either broad or very narrow spectral bands from thermal IR to UV wavelengths. They may be sensitive to polarization or phase of incident radiation, and may also work actively with laser beams for 3D imaging. The fundamental semiconducting material for IR FPAs can be HgCdTe or AlGaAs/GaAs quantum wells (or dots), InAs/GaSb superlattices as well as VO_x or amorphous Si, etc. Since EO imaging device technology is progressing very rapidly, it is difficult to treat the state-of-the-art technologies in a single book. Instead, this book intends to provide readers with a fundamental guide for understanding advanced FPAs of HgCdTe or AlGaAs based on third-generation IR fabrication technology. Emphasis will be on features of multipixel arrays for very large-scale and/or multiband use, pixel (column)-level analog to digital conversion, digital signal multiplexing and integrated processing. Some recent results obtained by the authors on device design and fundamental epitaxial fabrication processes are also presented.

The Chinese version of this book was published in 2011. Some updates and modifications for the present English version are made to reflect recent developments. The chapter dealing with optical links and data processing in the original version is removed due to space limitations in the English version which contains seven chapters. Chapter 1 briefly reviews the history and trends of IR FPAs. Advanced FPAs of HgCdTe or AlGaAs are outlined to provide readers with

background for the subsequent chapters. Chapter 2 presents numerical methods for designing HgCdTe multiband pixels. Chapters 3 and 4 present epitaxial techniques for multilayered HgCdTe devices on Si substrates and AlGaN, respectively. Device processing for pixel arrays of HgCdTe and AlGaN are discussed in Chaps. 5 and 6, respectively. Chapter 7 introduces methods for designing and testing CMOS readout circuits for dual-band preamps and analog to digital conversions.

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