Ultrastable and Uniform EUV and UV Detectors

S. Nikzad, T.J. Jones, T.J. Cunningham, P.W. Deelman, and S.T. Elliott
Center for Space Microelectronics Technology
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

The large imaging format, high sensitivity, compact size, and ease of operation of silicon-based sensors have led instrument designers to choose them for most visible-light imagers and spectrometers for space-based applications. In fact, technologies presently under development will tend to strengthen the position of silicon-based sensors. CCD-CMOS hybrids currently being developed combine the advantages of both imagers and new high-gain amplifiers and could permit photon-counting sensitivity even in large-format imagers.

Delta-doping is a technique developed at JPL to modify back-illuminated silicon detectors and CCDs for ultraviolet enhancement. In this approach, molecular beam epitaxy is used to modify fully-processed CCDs by growing 2.5 nm of boron-doped silicon on the back surface. The name "delta-doped" refers to the sharply-spiked dopant profile in the thin epitaxial layer. Delta-doped CCDs exhibit stable and uniform 100% internal quantum efficiency without hysteresis in the visible and ultraviolet regions of the spectrum. The quantum efficiency of delta-doped CCDs has been measured in the EUV/soft x-ray region of the spectrum at the Stanford Synchrotron Radiation Laboratory. In this paper we will discuss performance of delta-doped CCDs in UV and EUV, our in-house thinning capability, and bonding approaches for producing flat focal plane arrays. Recent activities on the extension of delta doping technology to CMOS and high resistivity technologies will also be discussed.

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