Designation: E2642 – 09 E2642 – 09 (Reapproved 2015)

Standard Terminology for Scientific Charge-Coupled Device (CCD) Detectors[1]

This standard is issued under the fixed designation E2642; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This terminology brings together and clarifies the basic terms and definitions used with scientific grade cooled charge-coupled device (CCD) detectors, thus allowing end users and vendors to use common documented terminology when evaluating or discussing these instruments. CCD detectors are sensitive to light in the region from 200 to 1100 nm and the terminology outlined in the document is based on the detection technology developed around CCDs for this range of the spectrum.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E131 Terminology Relating to Molecular Spectroscopy

3. Significance and Use

3.1 This terminology was drafted to exclude any commercial relevance to any one vendor by using only general terms that are acknowledged by all vendors and should be revised as charge-coupled device (CCD) technology matures. This terminology uses standard explanations, symbols, and abbreviations.

4. Terminology

4.1 *Definitions:*

advanced inverted mode operation (AIMO), *n*—a commercial tradename given to a method of reducing the rate of generation of dark current. Also known as **multi-pinned phase** operation.

analog-to-digital (A/D) converter, *n*—an electronic circuitry in a CCD detector that converts an analog signal into digital values, which are specified in terms of bits that can be manipulated by the computer.

anti-blooming structure, *n*—a structure built into the pixel to prevent signal charge above full-well capacity from blooming into adjacent pixels.

[1] This terminology is under the jurisdiction of ASTM Committee E13 on Molecular Spectroscopy and Separation Science and is the direct responsibility of Subcommittee E13.08 on Raman Spectroscopy.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

DISCUSSION—

Anti-blooming structures bleed off any excess charge before they can overflow the pixel and thereby stop blooming. These structures can reduce the effective quantum efficiency and introduce nonlinearity into the sensor.

antireflective (AR) coating, *n*—a coating applied to either the front surface of the CCD or the vacuum window surfaces, to minimize the amount of reflected energy (or electromagnetic radiation) so as to maximize the amount of transmitted energy.

back-illuminated CCD (BI CCD), *n*—a type of CCD that has been uniformly reduced in thickness on the side away from the gate structure (see Fig. 1b) and positioned such that the photons are detected on that side.

DISCUSSION—

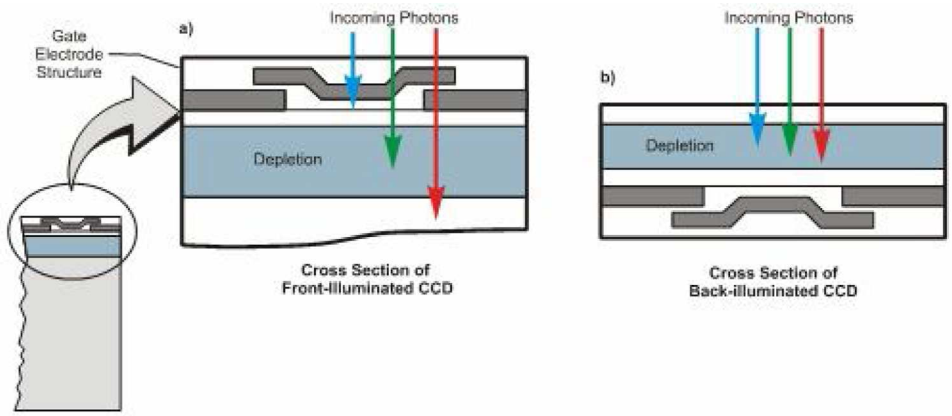

FIG. 1 Cross Sections of Front-Illuminated (a) and Back-Illuminated (b) CCDs

A BI CCD leads to an improvement in sensitivity to incoming photons from the soft X-ray to the near-infrared (NIR) regions of the spectrum with the highest response in the visible region. However, compared to a front-illuminated CCD, it suffers from higher dark currents and interference fringe formation (etaloning) usually in the NIR region. Also called back-thinned CCD.

binning, *n*—the process of combining charge from adjacent pixels in a CCD prior to read out.

DISCUSSION—

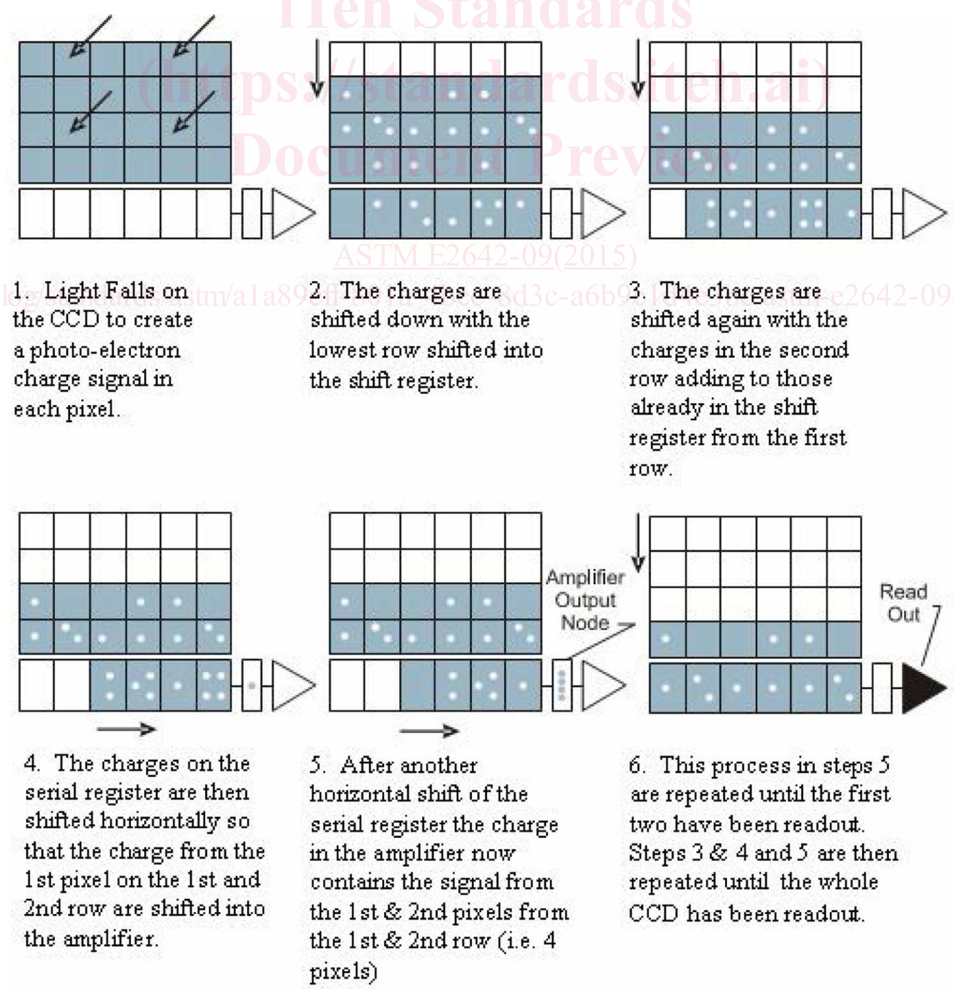

FIG. 2 Example of a 2 × 2 Vertical and Horizontal Binning Methodology