International Tables for Crystallography (2006). Vol. C, Figure 7.1.7.1, p. 633.

aided by the development of complete software packages to deal with all aspects of data collection and handling. Earlier program packages (Howard, Nielson & Xuong, 1985; Pflugrath & Messerschmidt, 1987; Thomas, 1987) tended to be specific to one particular detector and its associated diffractometer. However, following the initiative of Bricogne (1987) and with financial assistance from EEC funds, a group of scientists, including most of the originators of the earlier packages, are now collaborating in writing, extending, and maintaining a comprehensive device-independent position-sensitive-detector software package.

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7.1.7. X-ray-sensitive TV cameras (By J. Chikawa)

High-resolution X-ray imaging systems are required for the topographic study of spatial change in crystal structures, such as that which takes place in phase transformations. From this point of view, high-resolution TV camera tubes will be described.

7.1.7.1. *Signal-to-noise ratio*

Video displays of X-ray and optical images have different features. Although X-ray photon energies are very large, the intensities available in X-ray diffraction are extremely low compared with optical images. Therefore, the photon noise resulting from the statistical fluctuation of the number of photons incident upon an image system gives a detection limit of the image.

Consider the case of defects in a crystal viewed by an imaging system: ν_p photons s^{-1} mm^{-2} are diffracted from the perfect region of a crystal, and $q\nu_p$ ($q < 1$) are absorbed by the X-ray-sensing layer of the system. An absorbed photon produces a mean number η_1 of electrons or visible photons, each of which may be rescattered to produce a mean number η_2 of electrons or photons. By repeating s such processes, the mean signal height

$$S_p = q\,\nu_p\eta_1\eta_2\ldots\eta_s\delta^2 t \qquad (7.1.7.1)$$

is obtained from each square-shaped picture element $\delta \times \delta$ mm for t s. The value of δ may be taken as the limiting resolution of the system. Since $\eta_1 > 100$ owing to the large photon energy and the values of $\eta_2, \eta_3, \ldots, \eta_s$ are considered to be less than 100, the photon noise σ_p as a standard deviation of S_p is given by (Arcese, 1964)

$$\sigma_p = \eta_s\eta_{s-1}\ldots\eta_1(q\,\nu_p\delta^2 t)^{1/2}. \qquad (7.1.7.2)$$

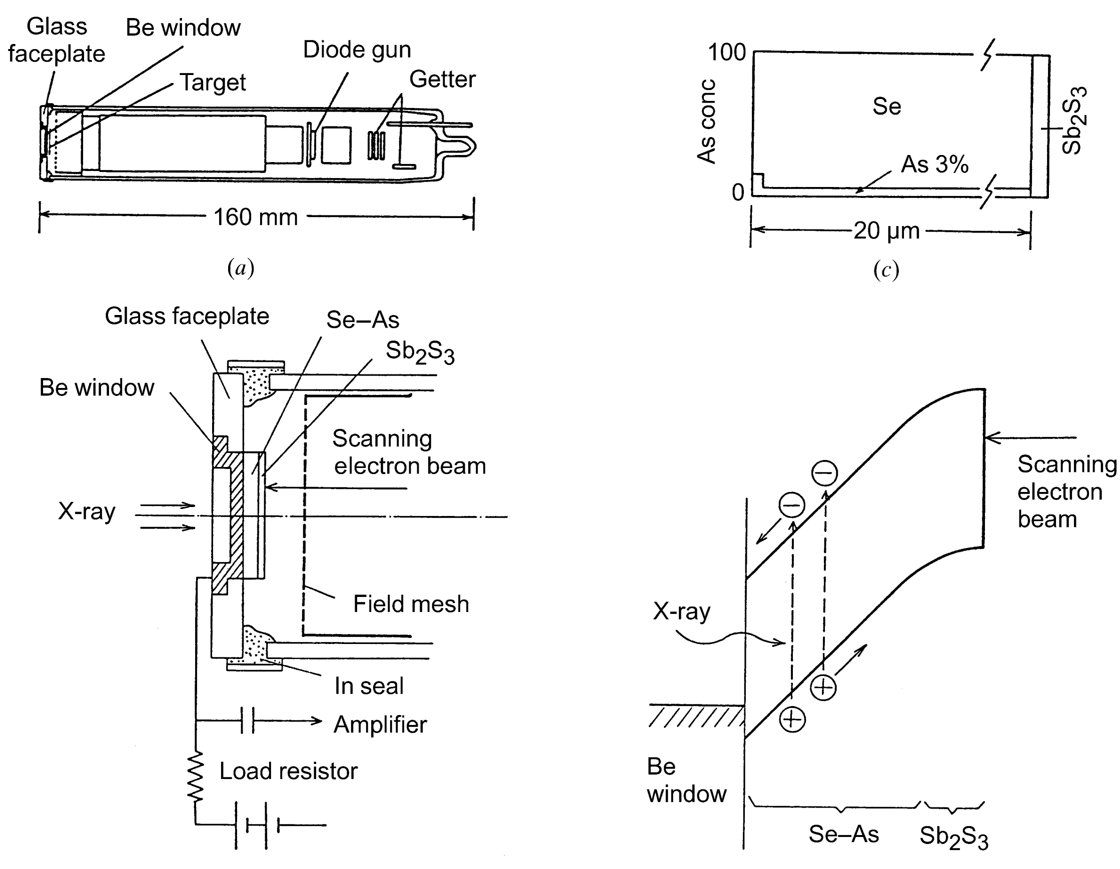

Fig. 7.1.7.1. Schematic illustration of an X-ray sensing Saticon camera tube. (*a*) Schematic representation of the tube. (*b*) Structure of the target. (*c*) Concentration (wt%) of As in the target (Se–As photoconductive layer). Since crystalline Se is metallic, As acts to stabilize the amorphous state. (*d*) Potential in the target. A blocking contact is formed between the X-ray window material and the Se–As alloy layer to prevent holes from flowing into the layer. Incident X-rays form electrons and holes in the layer, and the latter migrate toward the scanning-electron-beam side and contribute to the video signal. On the surface of the Se–As layer, Sb_2S_3 was evaporated to form another blocking contact that improves landing characteristics of the electron beam. By applying a high voltage on the layer, the holes are accelerated to produce multiplication (avalanche amplification), resulting in a great increase of the signal current.

references