NASA TECH BRIEF

Marshall Space Flight Center

Advanced Infrared Photomultiplier

The problem:

Present photocathodes used in the range from 8500 Å to 9000 Å are extremely inefficient.

The solution:

A photocathode for the 8500 Å through 9000 Å range which improves efficiency by an order of magnitude is achieved with a gallium arsenide cesium oxide ($GaAs\text{-}Cs_2O$) photocathode.

How it's done:

The GaAs emitter is composed of conventionally grown epitaxial layers doped with Mn (Manganese) at a $3.8 \times 10^{18}/cm^3$ acceptor concentration density. The substrate temperature when the polycystalline material is formed is 600°C; at 700°C, the layer appears to be single-crystal. Infrared photosurfaces inherently require atomically clean surfaces since contaminants greatly alter the low-energy threshold for photoemission. This is achieved and maintained with an ultra high vacuum. The surface is chemically cleaned, and a thin protective coating is formed over the crystal. This coating is stable to about 500°C, at which temperature it leaves the surface completely. This results in a clean surface. Another important function of the coating is to protect the GaAs surface from contamination during bake-out. The high-speed, crossed-field photomultiplier and image intensifier were then constructed in a conventional manner.

Note:

Requests for further information may be directed to:

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Reference: B72-10152

Patent status:

No patent action is contemplated by NASA.

Source: H. Sonnenberg and J. D. Taynal of
Sylvania Electronics Western Division
under contract to
Marshall Space Flight Center
(MFS-20941)

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