September 1971

Brief 71-10357

NASA TECH BRIEF

Marshall Space Flight Center

Optimum Doping Achieves High Quantum Yields in GaAs Photoemitters

The doping range resulting in optimum photoemission from GaAs-Cs_2O has been investigated more extensively. Previously, investigations of photoemission from p-type GaAs-Cs_2O were confined primarily to materials with an acceptor concentration in the range of 1×10^{19} to 5×10^{19} atoms per cm^{-3}. Recently, however, it was shown that, for low work-function surfaces of Cs_2O, quantum yields as high as those obtained on 4×10^{19} cm^{-3} Zn-doped GaAs-Cs_2O could be achieved in 2×10^{17} cm^{-3} GaAs. The photoemission from ultra-high vacuum cleaved GaAs-Cs_2O was measured in the acceptor density range between 3.3×10^{16} and 4.6×10^{19} cm^{-3}.

The data obtained from the experimental investigations clearly indicate that an optimum doping range exists. Measured quantum yield curves indicate that an optimum overall response is obtained in GaAs emitters with doping in the high 10^{18} cm^{-3} range. However, the doping for optimum response at a given wavelength is not necessarily in this range, as indicated in the figure where the quantum yield as a function of acceptor concentration is plotted, with wavelength as a parameter. For example, at 9250 Å, the higher the doping level, the better the response. At 9000 Å, peak response is obtained with GaAs doped in the low 10^{19} cm^{-3} range. At 8500 Å, the peak response is obtained in the 10^{18} cm^{-3} range.

As a general guideline, for overall optimum photoresponse, p-GaAs material with the highest electron mobility in the doping range between 6×10^{18} and 1×10^{19} cm^{-3} should be selected.

Note:

Requests for further information may be directed to:

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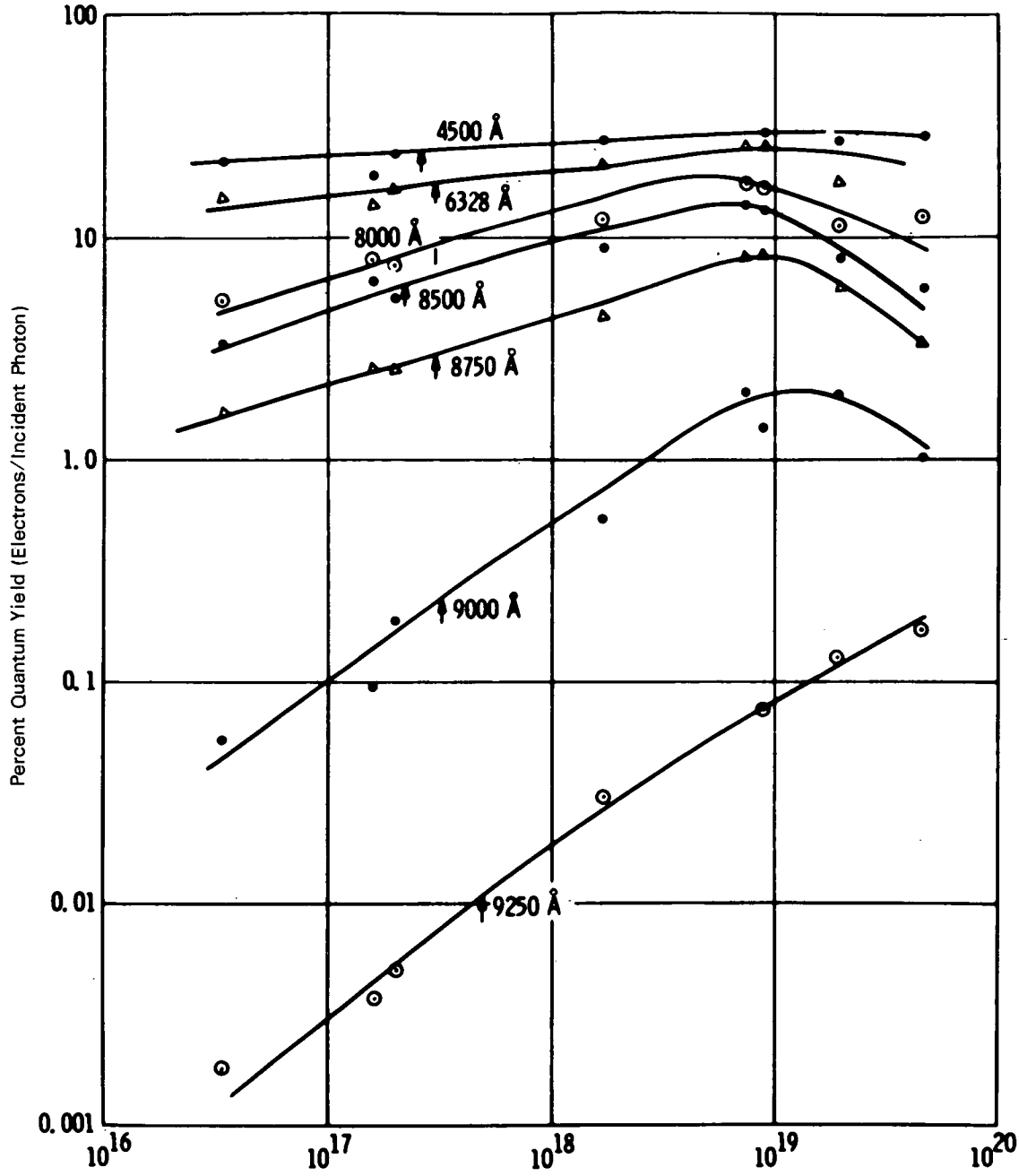
Reference: TSP71-10357

Patent status:

No patent action is contemplated by NASA.

Source: H. Sonnenberg of
Sylvania Electronic Systems
under contract to
Marshall Space Flight Center
(MFS-20962)

(continued overleaf)



Optimum Photoresponse of GaAs–Cs_2O as a Function of Doping, with Wavelength as Parameter.