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FINAL REPORT

Contract
NASw - 107

The University of Rochester

"Solid State Photodetectors and Associated
Optical Materials"

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Professor of Optics

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I. Research Findings

The results of the work carried out under this contract are described in detail in the publications and thesis listed below. In general, the work consisted of experimental studies of photoconductivity and photoemission from insulators and semiconductors, as well as studies of luminescence and the optical properties of such materials. In addition, contributions were made to the technology of spectroscopy in the vacuum ultraviolet, principally the design of small grating monochromators and phosphors with flat quantum yields. In connection with the latter work, considerable effort was expended on the measurement of the absolute quantum efficiencies of such phosphors.

As well as providing useful information about the immediate application of photodetectors and luminescent materials to the vacuum ultraviolet, the work greatly increased our understanding of basic processes governing the electronic behavior of large band gap semiconductors and insulators. For example, a greater knowledge of the band structure of the alkali halides and the interaction of primary excitations with phonon modes in these materials was obtained. Information was also obtained about the importance of inelastic collision of hot electrons in materials such as ZnS, and the role these interactions play in determining the magnitude of the quantum yield for photoemission. The processes which govern electron transport in amorphous materials such as selenium was also an area in which basic information was obtained.

As well as contributing directly to an understanding of the materials mentioned above, the research supported under this contract has enabled us to extend our investigations into two new areas. These are studies of the interaction of intense light beams with solids and the solid state spectroscopy of noble gas crystals. Our success in these areas can be directly attributed to the support obtained under NASw - 107.

II. Publications

A. M. Smith and D. B. Dutton (1961) Photoconductivity and the external photoelectric effect in PbS: J. Phys. Chem. Solids 22 351-363.

A. M. Smith and D. Dutton (1962) Photoconductivity and the external photoeffect in PbS: in "Conference on Photoconductivity", Proc. of the Photoconductivity Conference, Ithaca, N.Y., 1961, pp. 351-363, Pergamon Press.

- R. Illingworth (1963) Diffusion of thallous ions in single crystals of KBr: J. Phys. Chem. Solids 24 129-133.
- R. A. Knapp (1963) Photoelectric properties of lead sulfide in the near and vacuum ultraviolet: Phys. Rev. 132 (5) 1891-1897.
- R. A. Knapp (1963) A simple method for preparing layers of sodium salicylate: Appl. Opt. 2 (12) 1334.
- R. Illingworth (1964) Luminescent decay of KI:Tl, KBr:Tl, and KCl:Tl: Phys. Rev. 136 A508-517.
- R. A. Knapp and A. M. Smith (1964) Fatigue effects in the luminescent yield of sodium salicylate: Appl. Opt. 3 637-637.
- N. Kristianpoller (1964) Absolute quantum yield os sodium salicylate: J. Opt. Soc. Amer. 54 (10) 1285-1286.
- N. Kristianpoller and D. Dutton (1964) Optical properties of "liumogen": a phosphor for wavelength conversion: Appl. Opt. 3 287-290.
- N. Kristianpoller and R. A. Knapp (1964) Some optical properties of sodium salicylate films: Appl. Opt. 3 (8) 915-918.
- R. M. Blakney and H. P. Grunwald (1967) Small-signal current transients in insulators with traps: Phys. Rev. 159 (3) 658-663.
- R. M. Blakney and H. P. Grunwald (1967) Trapping processes in amorphous selenium: Phys. Rev. 159 (3) 664-670.

III. Theses

- J. K. Coulter (1960) Optical properties of PbSe films in the ultraviolet: UR Master's thesis.
- Abbot M. Smith (1961) Investigation of photoconductivity and photoemission in lead sulfide in the vacuum ultraviolet: UR Ph.D. thesis.
- Marshall G. Doane (1963) Optical properties of KCl, KBr, and NaCl in the vacuum ultraviolet: UR Master's thesis.
- Robert F. Edgerton (1963) Luminescence in the alkali halides: UR Ph.D. thesis.
- George R. Huggett (1963) Intrinsic photoconductivity in the alkali halides: UR Ph.D. thesis.

Richard A. Knapp (1963) Photoelectric emission from lead sulfide in the near and vacuum ultraviolet: UR Ph.D. thesis.

Hubert P. Grunwald (1965) Transport properties of amorphous selenium: UR Ph.D. thesis.

Dean B. McKenney (1965) Structure in the optical absorption edge of amorphous selenium: UR Master's thesis.

Thomas W. Blum (1966) Low temperature optical properties of RbCl, RbBr, and RbI in the vacuum ultraviolet: UR Master's thesis.

IV. Scientific Personnel

Kenneth Teegarden	Professor of Optics and of the Materials Science Program
R. M. Blakney	Associate Professor of Optics
David Dutton	Associate Professor of Optics
R. Illingworth	Research Associate
N. Kristianpoller	Research Associate
H. P. Grunwald	Research Assistant
R. A. Knapp	Research Assistant
A. M. Smith	Research Assistant