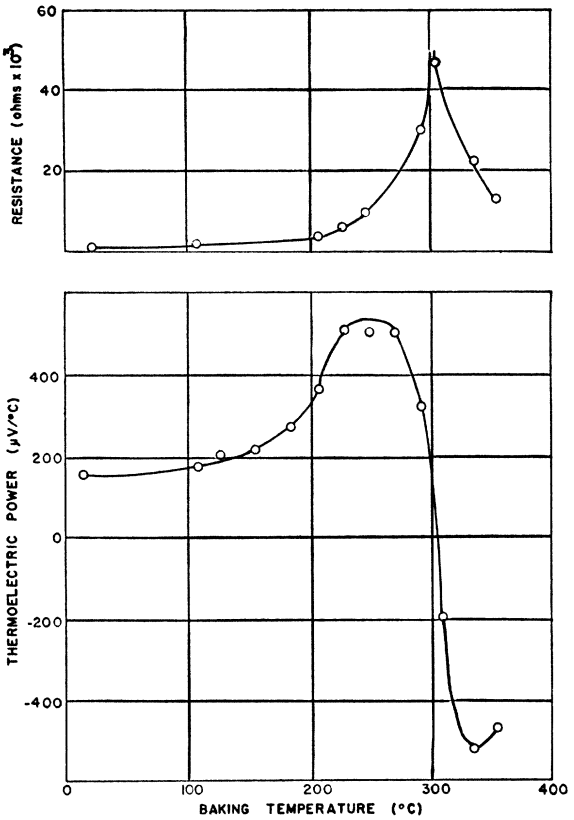

FIG. 1. Thermoelectric power and resistance of a lead telluride film as a function of film composition.

resistance reaches a maximum. Additional baking produces an excess lead film, as is indicated by the negative thermal voltage (electronic conductivity). The process has also been reversed. If one begins with an excess lead film and admits air into the vacuum system, the film resistance rises at first, then drops as the pressure in the vacuum system approaches atmospheric pressure. The thermal voltage is negative at first, becomes zero at the resistance maximum, then becomes positive. The diffusion of oxygen into the lattice thus changes the film from an electronic to a hole conductor. Additional experiments are now in progress to compare the results obtained with a hole conductor containing excess tellurium with those obtained when an excess lead film is made a hole conductor by the addition of oxygen.

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The Temperature Dependence of Organic Scintillation Counters

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THE temperature dependence of the light output of organic phosphors when subjected to gamma-radiation was measured for several different crystals and mixtures. Previous measurements by Graves and Koch[1] indicate irregularities in the light output of crystals as a function of temperature which they attributed to properties of the lattice. Their experimental arrangement was such that both photo-multiplier and crystal were varied in temperature during the course of the measurement. Measurements by Kelley and Goodrich[2] were made on anthracene radiated with β-particles. The present investigation differs in that the photo-multiplier was kept at liquid nitrogen temperatures while the crystal temperature could be varied in a separate insulated chamber. The light output was guided to the photo-multiplier by means of a Lucite rod or hollow aluminum tube depending on the type of crystal to be used and the extent of the contributions of the Lucite scintillations to those of the crystal under investigation. Measurements were made on the pulse distributions and total light output under gamma-ray excitation from a radium source. For pulse height distributions, the discriminator of the amplifier-scaler was so set as to reject Lucite scintillations. These measurements were consistent with measurements made on the total light output of the crystals, subject to the same excitation, the results of which are shown in Fig. 1. If we assume with Franck and Livingston[3] that the energy transfer process is one of sensitized fluorescence, the data suggest two possible explanations for the different characteristics of the same percentage of anthracene and stilbene in naphthalene; either the quenching occurs at the trapping molecule, or the quenching occurs during the exciton travel in the lattice. This quenching being greater for naphthalene-stilbene mixtures leads us to believe that it is due to the greater possibility of energy reflection from the stilbene molecule, subjecting excited naphthalene molecules to thermal perturbations for longer periods of time. This is further borne out by the lower quantum efficiencies for naphthalene-stilbene mixtures as compared to naphthalene-anthracene mixtures. No differences were found between temperature measurements on single crystals or their powders.

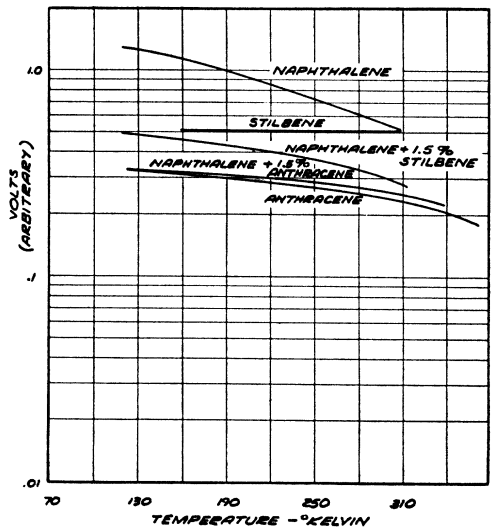

FIG. 1. Temperature variation of integrated light output.

The naphthalene and anthracene single crystals were obtained from the Harshaw Chemical Company. The anthracene used in mixtures with naphthalene was obtained from Eastman Kodak Company. The stilbene crystal was grown by Dr. S. Zerfoss and Mr. L. R. Johnson of this Laboratory, and the other samples were made by solidifying from the melt in a metallographic specimen press.

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[3] J. Franck and R. Livingston, Rev. Mod. Phys. **21**, 505 (1949).