

## I. PHYSICAL ELECTRONICS

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### A. PHYSICAL ELECTRONICS IN THE SOLID STATE

#### 1. Characteristics of Junctions in Germanium

Measurements of the low-voltage characteristics of germanium alloy-junction rectifiers reported in the Quarterly Progress Reports of April 15, 1957, p. 7 and July 15, 1957, p. 1 have continued with the measurement of the apparent junction barrier height in a type 1N91 commercial rectifier. If the barrier height is given by

$$B = B_0 + a V_T$$

then the constants for this junction are  $B_0 = 0.592$  volt, and  $a = -1.09$ .

An attempt is being made to construct a chopper amplifier with a high input impedance to facilitate these measurements. A commercial chopper (Stevens-Arnold Model A-12-12-D) working into a low-noise amplifier has produced a random noise level of approximately  $10 \mu\text{v}$ , with an input impedance of 6 megohms. Work on improving this performance continues.

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#### 2. Surface States on Semiconductors

In this study the effect of traps on the photoconductive characteristics of germanium is investigated. We believe that there is a large number of traps on the surface of germanium, and that these traps have an effect on its photoconductivity at temperatures of approximately  $200^\circ \text{K}$ . This effect consists of, among other things, a relatively slow decay of the conductivity induced by injected carriers which can be observed on an oscilloscope. In previous experiments (H. A. Gebbie and E. Ahilea, Quarterly Progress Report, July 15, 1955, p. 3) the amount of this effect was found to change when the residual gas around the sample was bombarded with a Tesla coil.

In this experiment, the sample was connected to a constant-current source and an oscilloscope (through an amplifier) and illuminated by chopped light. The sample was cooled by dry ice in acetone. There was no evidence of slow decay of photoconductivity and, even after oxygen was introduced into the system and bombarded with a Tesla coil, the decay was almost instantaneous. The causes of the absence of slow decay are being studied.

E. Ahilea

#### 3. Electroluminescence

Studies are being initiated in the field of electroluminescence. An electroluminescent phosphor in powder form will be held in a dielectric binding material between

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two conducting surfaces. Sheets of polystyrene (of thicknesses from 0.001 to 0.005 inch) were prepared between plates of transparent, conducting glass, the process starting with the monomer styrene. Voltage will be applied to the phosphor dielectric sandwich in the form of pulses. A pulse generator that will supply a 0-350-volt trapezoidal pulse has been designed and built. The rising and falling slopes are linear, and their durations are independently variable from 100  $\mu$ sec to 100 sec. The duration of constant voltage is variable over the same range. The triggering circuit will initiate one or two pulses, or will cause free running.

An investigation of the initial release of electrons and subsequent polarization effects and of distinguishing between the proposed release and excitation mechanisms is proposed.

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