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SESSIONS N AND O

729

SATURDAY MORNING AT 9:30

Sherman, Louis XVI Room

(J. H. VAN VLECK presiding)

Invited Papers

N1. UNESCO and International Cooperation in the Physics Sciences. RONALD FRASER, *International Council of Scientific Unions*. (20 min.)

N2. Photoelastic Analysis of Ultrasonic Waves. E. A. HIEDEMANN, *Michigan State College*. (30 min.)

N3. Recent Experiments with the University of Michigan Shock Tube. OTTO LAPORTE, *University of Michigan*. (30 min.)

N4. The Interaction of π -Mesons with Protons. HERBERT L. ANDERSON, *University of Chicago*. (30 min.)

SATURDAY AFTERNOON AT 2:00

Sherman, Crystal Room

(JOHN BARDEEN presiding)

Semiconductors, II

O1. Energy Levels in KCl. L. G. PARRATT AND E. L. JOSSEM, *Cornell University*.—Evidence is presented for the existence of discrete filled "ionization" levels below the filled $3p$ band of potassium and of chlorine in crystalline KCl in the immediate locale of a $1s$ vacancy. This evidence comes from observed shapes, widths, and energy positions of component lines in the $K\beta$ x-ray emission spectra. These lines were recorded with the newly constructed focusing crystal spectrometer previously described.¹ Also, evidence is presented for local discrete empty "excitation" levels below the ionization continuum. This evidence comes from an interpretation of the x-ray absorption spectra in the region of the K edge of potassium and of chlorine as recorded by Trischka.² Based upon these measurements and tentative interpretations, an energy level diagram for KCl is proposed to account for the component x-ray emission and absorption lines, and the enigmas of (1) the experimentally narrow β_1 line (0.92 ev full width at half-maximum for potassium and 0.67 ev for chlorine), (2) the unexplained component lines accompanying β_1 , and (3) the absorption maxima and minima are tentatively resolved.

* Supported in part by the ONR.

¹ E. L. Jossem and L. G. Parratt, *Phys. Rev.* 79, 210 (1950).

² J. W. Trischka, *Phys. Rev.* 67, 318 (1945).

O2. Anionic Self-Diffusion and Electrical Conduction in Sodium Bromide. H. W. SCHAMP, JR.*—The diffusion coefficient of the radioactive bromide ion in sodium bromide was measured by evaporating a thin layer of sodium bromide containing the radioactive bromide ion onto one face of a single crystal of the compound, heating this exposed specimen for a definite length of time (360°C–688°C), cooling it, and then sectioning it to determine the distribution of radioactivity within the crystal. Above 450°C the results of the direct measurement of the diffusion coefficient are quantitative and can be expressed as $D_B = 50 \exp(-2.02/kT)$ cm²/sec. It is shown that below this temperature the actual coefficient is certainly lower than the measured value. The diffusion coefficient calculated from conductivity can be expressed as $D_{\text{calc}} = 4.36 \exp(-1.66/kT)$ at high temperatures and as $D_{\text{con}} = 6 \times 10^{-6} \exp(-0.80/kT)$ at low temperatures. The ratio $D_B/D_{\text{con}} = 11.5 \exp(-0.36/kT)$ is taken as a measure of the transport numbers in the range of temperatures from 500°C

to 700°C. It is shown that at low temperatures the diffusion coefficient directly measured is at least 30 to 40 times smaller than the coefficient calculated from conductivity, and it is concluded that the existence of pairs is unlikely.

* AEC Predoctoral Fellow.

O3. The Effect of Pressure on the Position of the F -band in Alkali Halides. E. BURSTEIN, J. J. OBERLY, AND J. W. DAVISSON, *Naval Research Laboratory*.—The effect of hydrostatic pressure on the position of the F -band in NaCl, KCl, and KI has been investigated up to 2000 atmospheres. The measured shifts in the position of the F -band, like those due to temperature changes, are found to be larger than the values calculated from the known dependence of the position of the F -band on the lattice constant of the various alkali halides. Further, the ratio $\Delta E_{\text{obs}}/\Delta E_{\text{calc}}$ increases in the order $KI < KCl < NaCl$. In terms of the "particle-in-a-box" model for the F -center¹ the discrepancy between experimental and calculated values may be attributed to the fact that the trapped electron exerts a considerably smaller repulsion on its neighbors than the halogen ion it replaces, so that the neighboring alkali metal ions which make up the walls of the box in which the electron is trapped are displaced from their normal position in the lattice toward the electron. Preliminary calculations based on these considerations show that, other factors being equal, the shift in the F -band should increase with decreasing compressibility of the host crystal in agreement with the experimental results.

¹ E. Burstein and J. J. Overly, "Optical properties of F -centers at liquid helium temperatures," Low Temperature Symposium, National Bureau of Standards (1951).

O4. Rectification Effects in Diamond. G. W. CURL AND G. C. DANIELSON, *Iowa State College*.—Point contact rectification has been observed both in counting and in photoconducting diamonds. The counting rate and the photoconducting current are usually greatest when the probe is the positive electrode, but the degree of rectification varies greatly with different diamonds. In the case of photoconductivity, the rectification effect has been investigated by applying an alternating potential to a circuit consisting of a diamond and a capacitor in series. The direct current potential appearing on the capacitor is measured by an electrometer circuit. The de-