

MEASUREMENTS OF THE EXTERNAL PHOTOELECTRIC EFFECT OF POLYCRYSTALLINE LAYERS OF ALKALINE HALIDES BY MEANS OF A G.-M. COUNTER

By B. SUJAK

Institute of Experimental Physics, Bolesław Bierut University, Wrocław

(April 21, 1953)

It is well known that alkaline halides which possess additional absorption bands in the optical region of the spectrum show there an external photoelectric effect (Lukirsky and al. 1926, Fleischmann 1933, Apker and Taft 1950, 1951) with a weak quantum yield of $10^{-5} - 10^{-7}$ electrons per quantum (Fleischmann 1933, Apker and Taft 1950, 1951).

To investigate the photoelectric emissivity of NaCl and KCl layers at different wave lengths of the visible spectrum a cylindrical G. M. photon counter was used. The thickness of the layers, obtained by evaporation of aqueous solutions, did not exceed 10^{-1} mm; they were deposited on an inner side of the counter cathode whose opposite side was removed (see Fig. 1). The photoeffect was detected and measured after foregoing sensitization by a continuous discharge in the counter; without such a sensitization the layers did not show any photoelectric emission produced by visible light, which is in agreement with previous observations of other authors (Lukirsky, Gudris and Kulikowa 1926; Fleischmann 1933; Apker and Taft 1951; Kramer 1951). If the measured effect is small (it decreases with prolonged exposure to light, an effect known as photoelectric fatigue), it may be increased by raising the applied voltage so as to produce anew a continuous discharge in the counter.

Our observations showed also the existence of an influence of the applied voltage across the counter during its normal work on the observed photoelectric emission. To be sure that this effect is not caused by photoluminescence (anti-Stokes radiation: NaCl — 2400 Å, KCl — 2700 Å, see Kac 1948) two counters were mounted in one glass container, the cut out parts of their cathodes facing one another (see Fig. 1). In this assembly counter No. 1 responded strongly to visible light (Fig. 2), whereas counter No. 2 showed no increase of background. This seems to justify the conclusion that the effect produced in counter No. 1 was not due to anti-Stokes radiation in the 2000—3100 Å region. Measurements of the external photoelectric effect from excited NaCl layers showed the existence

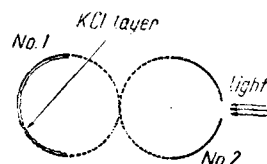


Fig. 1. Cross-section of the counter assembly

of a maximum of photoemission in the neighbourhood of $480\text{ m}\mu$, whereas for KCl this maximum lay in the vicinity of $570\text{ m}\mu$. Fig. 2 shows the spectral distribution of photoemission (curves a and a'). On the vertical axis are given the rates of counting in arbitrary units, reduced to equal incident light intensity for different wave lengths and to equal geometries of the assembly. For comparison

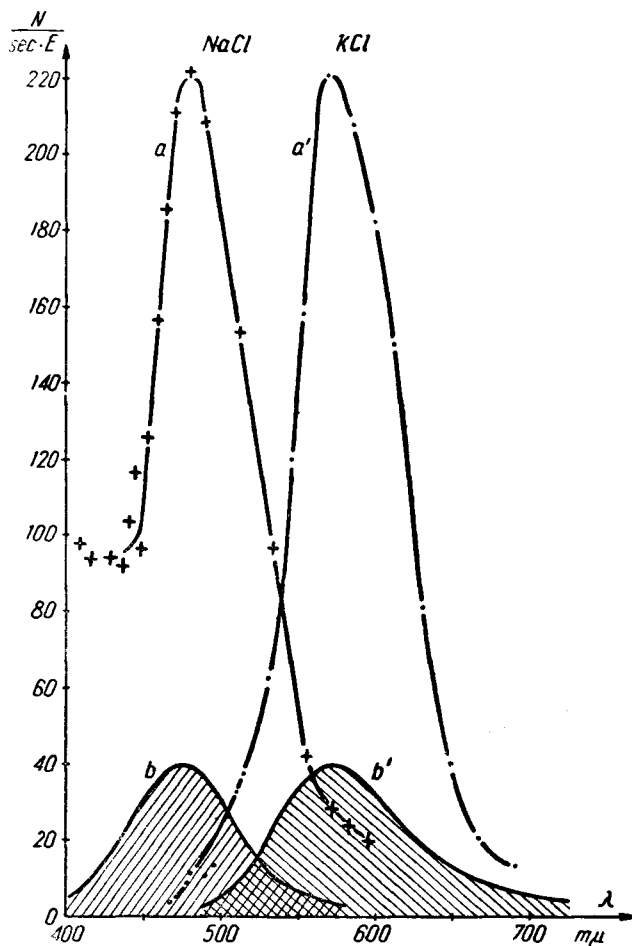


Fig. 2. Spectral distribution of the photoelectric emission of excited layers of NaCl (curve a) and KCl (curve a'). Curves b and b' — absorption bands of NaCl and KCl in arbitrary units

the maxima of optical absorption for NaCl and KCl containing F-centers (in arbitrary units) are also shown in the diagram (Fig. 2, curves b and b' — see Pohl 1938). Preliminary observations showed a dependence of the heights of the maxima of photoemission on the time of excitation, but no influence of that time on the position of the maxima. The agreement of the shape of the curves and the constancy of the position of the maxima lead us to assume that we have to deal here with an effect connected with the existence of F-centers in the investigated layers. It seems that the smallness of the effect would render its investiga-

tion by other methods rather difficult. The intensities of the photoelectric currents were of the order of 10^2 — 10^3 electrons per second, corresponding to 10^{-17} — 10^{-16} amperes, in the neighbourhood of the maximum of emission. As source of light it was used a tungsten point-lamp and a double monochromator of Polish make.

Further investigations of the external photoelectric effect of polycrystalline layers as well as monocrystals of alkaline halides and other semiconductors are now in progress.

The author wishes to express his gratitude to Professor J. Wesołowski and Professor J. Nikliborc for numerous helpful discussions.

REFERENCES

- Apker L. and Taft E., *Phys. Rev.*, **79** 964 (1950); *Phys. Rev.*, **81**, 698 (1951).
Fleischmann R., *Z. Phys.*, **84**, 717 (1933).
Kac M.L., *Zh. eksper. teor. Fiz.*, **18**, 165 (1948).
Kramer J., *Z. Phys.*, **129**, 34 (1951).
Lukirsky P., Gudris N. and Kulikowa L., *Z. Phys.*, **37**, 308 (1926).
Pohl R.W., *Phys. Z.*, **39**, 36 (1938).