

THE REFLECTING POWER OF ALKALI METALS IN  
CONTACT WITH GLASS—AS DETERMINED  
BY THE PHOTO-ELECTRIC CELL

ABSTRACT

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As a photometer, one of the most sensitive cells made by Dr. J. Kunz, was employed. The cathode consisted of rubidium deposited by distillation on a film of silver, the rarified gas being argon. A metallic guard ring properly earthed is located between cathode and anode.

Due to conflicting literature on the relation between the light intensity and the corresponding photo-electric current, it was decided to calibrate the cell in terms of known light intensities, as determined by the aid of crossed Nicol prisms. The source of light used was a Nernst glower, due precautions being taken to exclude extraneous light. The cell itself was in an earthed metallic box. A galvanometer, having a figure of merit of  $2 \times 10^{-10}$  amp. per mm., at a scale distance of  $2\frac{1}{2}$  meters was employed to measure the current. The resulting curves obtained for various voltages, between the light intensity and the photo-electric current were found to be *not quite* straight lines, but curves which were *slightly* concave towards the illumination axis. In all succeeding determinations of reflecting powers, proper corrections were made in accordance with the curves obtained.

In the determinations of the reflecting powers of the alkali metals, the photo-electric cell was mounted on the telescope

of a spectrometer, thus facilitating the determination of the angles of incidence of the light on the alkali mirrors.

Great difficulties were encountered in making the mirrors. These were made both by repeated distillations and pourings. The metal was deposited on a glass plate which formed a part of a small cell. The reflecting power of the alkali metals in contact with the glass is given by  $R = \frac{O-r}{t^2(1+Or-r'r')}$

O is the fraction of incident light reflected by the whole mirror, (metal plus glass); r is the reflecting power of the glass surface from air to glass to air; r' is the reflecting power of the glass surface going from the glass to air to glass; and t is the transmission power of the glass plate for a single passage through the glass plate.

The values of t and r' for various angles of incidence are given by the equations,  $t = \frac{T^2 + (1-R')(R'-r)}{T(1-r)}$ ;  $r' = \frac{(R'-r)(1-r)}{T^2 + (1-R')(R'-r)}$

T is the fraction of incident light transmitted by the glass plate and incident on the photo-electric cell. R' is the reflecting power of the glass plate (both surfaces). There are no approximations in the derivation of these equations.

The investigations of the properties of the glass plates, showed that r' is somewhat less than r. The values of r were obtained by abrading and blackening the surface of the glass plate, thus leaving only one surface effective.

Potassium gave reflecting powers of 88 per cent at 9° incidence to 89 per cent at 35°. A mirror formed by pouring the metal against the glass plate gave results coincident with those from one formed by distillation. Only one rubidium mirror has been investigated so far, its reflecting power at an angle of incidence of 9° being 76.3 per cent. This was increased to 78 per cent at 35°. Sodium gave reflecting powers increasing from 89 per cent at 9° to 91 per cent at 35°. The reflecting powers of the alkali metals therefore decrease as the atomic weight increases.

Note—So far, non-polarized light has been used. Subsequent to the report on this work the investigation was carried out, using monochromatic and polarized light. A full account of this investigation is to appear in a fall (1916) number, probably the October number) of the *Astrophysical Journal*.