pared with "white" light. It has been verified that the ratios of the intensities of these two lights differ by many per cent. by the direct comparison and flicker methods.

The maximum values of sensation produced by these colored lights differ considerably at all frequencies of flicker up to vanishing-flicker frequencies. The speed at which flicker disappears is always lower for the blue-green light for equal intensities as measured by the direct comparison method. When blue-green light is flickered upon a steady red field the speed at which flicker disappears is much lower than for the case of red light flickering upon a steady green field. In these cases the illuminations on the photometer screen are balanced for equality by the direct comparison method. The speed or frequency at which a balance is made with the flicker photometer is found to be lower than the speeds of vanishing flicker for the two lights. There is a considerably greater overshooting of luminous sensation in the case of the red light flickering upon a steady blue-green field than in the case of blue-green light flickering upon a steady red field.

It is also found that the vanishing flicker frequency depends upon the shape of the "illumination wave," that is upon the contour of flicker. This suggests a possibility that flicker photometers differing in principle may give different results. The results indicate that the importance of the different rates of growth and decay of color sensations have not been considered seriously enough in connection with flicker photometry. It seems that the differences between the results by the direct comparison and flicker methods can be largely accounted for in the above phenomena.

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REVERSIBLE TRANSITIONS BETWEEN SOLIDS AT HIGH PRESSURES.¹

BY P. W. BRIDGMAN.

A LARGE number of substances have been examined over the range from 0° to 200° and from atmospheric pressure to 12,000 kgm. per sq. cm. The reversible transitions from one solid to another which occur within this range have been studied, and the relation between pressure and temperature along the transition lines, the difference of volume between the different forms, and the latent heat of transition have been determined. Data have been obtained for the following substances: AgI, NH₄NO₃, HgI₂, C₂Cl₆, KNO₃, KClO₃, AgNO₃, KSCN, NH₄SCN, KNO₂, and CsNO₃. Of these NH₄NO₃, KClO₃ and KNO₂ have each one new form not known before, and KNO₃ has two new forms. Particularly striking are the very rapid curvature of the AgNO₃ line, and the fact that there is a maximum temperature of transition between the red and the yellow modifications of HgI₂. The results for these various substances show nearly all possible kinds of behavior. This is different

¹ Abstract of a paper presented at the Washington meeting of the Physical Society, April 24-25, 1914.

from the behavior on the transition curve from liquid to solid, where all substances give results of only one type.

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SURFACE LEAKAGE OVER INSULATORS.¹

BY HARVEY L. CURTIS.

THE resistance between two conductors insulated by a solid dielectric usually depends very largely on the surface condition of the dielectric. If the insulator is in a humid atmosphere, condensation of moisture is known to take place on the surface and this increases the surface leakage. This paper will attempt to find a connection between the moisture condensed and the surface leakage.

The surface resistivity is defined as the resistance between two opposite edges of a surface film which is one centimeter square. The surface conductivity is the reciprocal of this. The surface resistance of most insulators varies greatly with the humidity of the surrounding air. In one case (hard rubber which had been exposed to the sunlight) the surface resistivity in very dry air was nearly one trillion (10^{12}) times as large as in very humid air. With waxy materials such as paraffin, ozokerite and beeswax, there is very little change with the humidity but all other insulators show marked changes. A factor of 10^5 or 10^6 between high and low humidities is not uncommon. It is to be expected that this change in surface resistivity is due to condensed moisture.

The thickness of the surface film of water upon quartz and glass has been determined by weighing. Knowing this thickness and the surface resistivity, the conductivity of the surface film is readily computed.

Ihmori² found the thickness of the water film on quartz by weighing. With cleaned specimens at about 90 per cent. humidity the thickness was about 0.5×10^{-6} centimeters. With uncleaned specimens the thickness was found to vary from 1.4×10^{-6} to 6.2×10^{-6} . The surface resistivity of quartz at 90 per cent. humidity which had been carefully cleaned was found to be about 10^{12} ohms per centimeter square. This gives the conductivity of the water of the film as 2×10^{-6} reciprocal ohms per centimeter cube, which corresponds to a high grade of distilled water. With the uncleaned specimens the surface resistivity was as low as 10^8 ohms per cm. square. Assuming that this corresponds to the thickest film found by Ihmori, the conductivity of the water is 0.0017 reciprocal ohms per centimeter cube. Since the quartz is insoluble, the increased conductivity is due to soluble salts which were present on the surface. If it were entirely due to sodium-chloride, there must have been 6×10^{-9} gram of the salt on each square centimeter.

In the case of glass, it was found that careful cleaning produced much less change in the surface resistivity than in the case of quartz. In fact with soft

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² Wied Ann., 31, p. 1006; 1887.