

and the 3,470 line were unusually strong in comparison with the rest of the spectrum. The remarkable resemblance between this auroral spectrum and the high-pressure afterglow spectrum discovered by me led Bernard to interpret the radiation at 3,470 as a line rather than as the 2 *P.G.* (3-4) band as proposed by Vegard. One must give Bernard credit for an important new observation in recognizing this resemblance.

It must be pointed out that Vegard's interpretation of this 3,470 radiation as a nitrogen band is very difficult to understand. As support for this interpretation, Vegard cites the fact that other bands of the progression 2 *P.G.* (3-*n*) appear in the auroral spectrum. These other bands should be much more intense, however, than the band 3469 (3-4), whereas in Vegard's own auroral spectra the 3469 band is the most intense of the three bands 3285 (3-3), 3671 (3-5) and the 3469 band. An examination of any laboratory source of this system will show immediately that this discrepancy will rule out Vegard's explanation and lends support to that proposed by Bernard. Furthermore, the band at 3469 is stronger than the 3500 band in the same sequence. In the large number of afterglow and discharge spectra that have been photographed by me during the last decade, I have never observed such a large enhancement in the intensity of this band as that implied by Vegard. It appears, therefore, that the greater part of the radiation at 3470 is due to the ^2P-4S line, and only a very small fraction to the 3-4 band.

I have also obtained some new spectra which should further help to settle this question. Several years ago² I produced the green auroral line in rapidly interrupted weak discharges with remarkably large relative intensity. Accompanying this weak discharge was an afterglow showing an equally remarkable enhancement of the Vegard-Kaplan bands. It was recently possible to duplicate this phenomenon in the high-pressure afterglow. In this case the new nitrogen line (instead of the auroral green line) is so strong that it is at least ten times as intense as the strongest second-positive band. This new experiment leaves no question in my mind as to whether the radiation around 3470 is a band or a new line, and it also adds heavily to the evidence which favours both Bernard's identification as well as my proposal that the line is the transition ^2P-4S in atomic nitrogen.

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¹ Vegard, L., *NATURE*, 142, 670 (1938).

² Kaplan, J., *Pub. Astr. Soc. Pac.*, 47, 257 (1935).

Photo-sensitive Titanium Dioxide

ATTENTION has already been directed to the reversible darkening in daylight exhibited by some varieties of commercial titanium dioxide¹. Mechanisms for this darkening were suggested and the possibility that the phenomenon is connected with iron present as an impurity in the titania was borne in mind. Titanium dioxide contaminated by iron, which shows rapid reversible darkening in daylight, has been prepared by the following simple process.

Titanium dioxide is mixed with an aqueous solution containing enough iron salts to add 0.2 parts by weight of Fe_2O_3 to 100 parts by weight of TiO_2 . The mixture is evaporated to dryness. The residue

is ground for a few minutes and then calcined for three hours to a final temperature of 1,000° C. Calcination is performed in a metallic resistance furnace wherein the titania is freely exposed to air. The resulting readily pulverizable product when ground is ready for study.

The titanium dioxide used in the experiments showed no perceptible darkening in daylight and gave the following spectrographic analysis (prepared by Messrs. Adam Hilger, Ltd.). Ca, trace; Fe, very slight trace; Na, very slight trace, practically 0; P, trace; Pb, minute trace, practically 0; Sb, slight trace; Si, heavy trace; Sn, minute trace. Elements sought with negative result: Ag, Al, As, B, Ba (probably; lines masked), Be, Bi, Cd, Co, Cr, Cu, K, Li, Mg, Mn, Mo, Ni, Sr, Th, Tl, V, W, Zn, Zr.

Iron was added to this oxide as ferrous sulphate or ferric ammonium sulphate, both of analytical reagent quality.

Very precise standardization of quantities or heating schedules is not necessary to obtain striking results. Moreover, there is evidence that certain metals other than iron, used as contaminators, give rise to photo-sensitive preparations.

It is hoped to give a fuller account of the subject of this communication, and of related matters, at a later date in the *Transactions of the British Ceramic Society*.

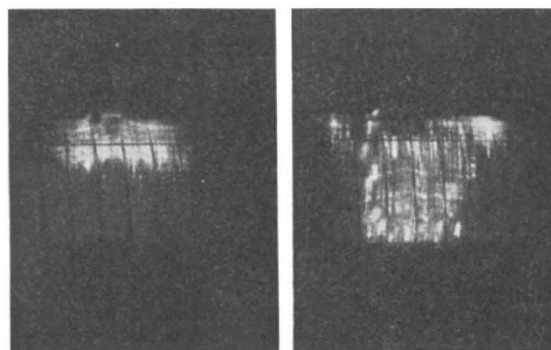
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¹ Williamson, W. O., *NATURE*, 140, 238 (August 7, 1937).

Migration of Barium on Molybdenum

IN a previous letter¹ we stated that no evidence had been obtained for the surface migration of barium over nickel or tungsten. We have recently published these results² in detail, together with the results of the behaviour of thorium on tungsten.



(a) INITIAL DEPOSIT OF BARIUM OVER PART OF WIRE SURFACE. (b) COMPLETE MIGRATION AROUND WIRE AFTER 20 HOURS AT 1010° K.

The electron microscope described for round wires has been used to study the behaviour of barium on molybdenum. It has been found that over the temperature range of approximately 1,000°-1,050° K., barium migrates uniformly over molybdenum. Below 1,000° K. no movement occurs, and above 1,050° K. evaporation of barium takes place very rapidly.