Regardless of this difference, however, it seems that Menzel's use of my experiments as observational proof of the points raised in his letter is a proper one. In fact, experiments at higher pressures and in smaller tubes have resulted in even higher relative intensities for the metastable transitions than those reported last spring. It is gratifying to see that my prediction of the possible astrophysical interest of these results has already been justified.

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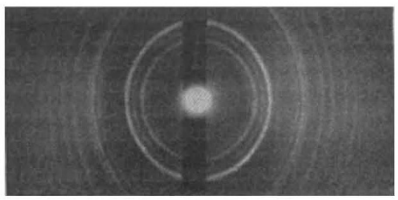
[1] Menzel, D. H., NATURE, 142, 644 (1938).

Conversion of Vitreous and Monoclinic (α) Selenium to the Hexagonal Modification

SELENIUM is known to exist in several stable allotropic modifications, of which the structures of the hexagonal and the monoclinic varieties (α and β) have been determined by Bradely[1] and Klug[2] respectively.

Prins and Dekeyser[3] have investigated the gradual conversion of vitreous or amorphous selenium into the hexagonal variety at high temperatures and have also studied the influence of tension on this conversion. From their experiments they concluded that:

(*a*) The transformation of vitreous selenium into the hexagonal variety may take place at as low a temperature as 60° C., if a thread of vitreous selenium is kept under tension at that temperature.



(*b*) In the absence of tension, the crystallization does not take place below 73° C. The tension, therefore, helps the devitrification of vitreous selenium; and the fact that the degree of crystallization is most marked in the surface layers of a heated selenium stick and gradually becomes less in the deeper layers has also been suggested by them as due to the presence of mechanical stress, already present in the surface layers owing to the 'quenching' method of its preparation.

In the course of our investigations on selenium, we have obtained results which in many respects deviate from those of the previous authors. We find that, if thoroughly powdered specimens of vitreous selenium be maintained at a temperature even as low as 43° C., devitrification of the specimen sets in and gradually progresses with the period of heating, and after a considerable period, say about two weeks, a complete transformation into the hexagonal variety is clearly indicated by the appearance of only sharp diffraction rings on a clear background in its X-ray powder diagram. The powder-pattern obtained in this final stage is reproduced in the accompanying figure (taken with a hemicylindrical camera).

In the experiment mentioned above, we used powdered sticks of vitreous selenium; the diffracting specimen evidently consisted mostly of particles lying in the deeper layers or in the body of the sticks, where the material is supposed to be free from any mechanical stress. Thus the experiment shows that even in the absence of tension, crystallization of vitreous selenium is possible at 43° C., if not at still lower temperatures. Insufficient period of heating the specimen is undoubtedly the cause of failure of the previous authors[3] to detect the crystallization, which is extremely slow at lower temperatures.

In the case of monoclinic (α) selenium, we also find that the transformation into the hexagonal variety is quite rapid at 100° C. and may be detected after 24 hours of heating, whereas the same process is so slowed down at 80° C. that it cannot be detected before several days have passed.

Experiments are in progress to determine the lowest temperature at which these transformations take place. We are of opinion that in every case of monotropic structural transformation there is a critical temperature, below which the transformation in question cannot take place. At this temperature the molecules of the substance acquire the mobility which is required for their correct marshalling in the new structure.

A rise of temperature in all these cases increases the time-rate of conversion and thus minimizes the time required for the complete conversion of the whole specimen. Another example of this type of monotropic change which has been thoroughly studied by one of us[4] is the conversion of Sω or white sulphur into Sα or orthorhombic sulphur. Here both Sω and Sα are the two different crystalline phases of sulphur.

Results of the investigation on selenium will be published in more detail in the *Indian Journal of Physics*.

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[1] Bradely, *Phil. Mag.*, 48 (1924).
[2] Klug, *Z. Krist.*, **88** (1934).
[3] Prins and Dekeyser, *Physica*, **4** (1937).
[4] Das, *Ind. J. Phys.*, **12** (1938).

Spectrum of Potassium Deuteride

A PRACTICALLY uncontaminated KD spectrum was obtained in an arc between potassium (negative) and nickel (positive) electrodes burning in a deuterium atmosphere of 50–30 cm. mercury pressure, and was photographed in the first order of a 15-ft. grating spectrograph having a dispersion of 3·7 A. per mm.

In the strongest part of the many-lined spectrum between 4300 A. and 5100 A., the $v'' = 0$ progression bands $7 \rightarrow 0$, $8 \rightarrow 0$ . . . $20 \rightarrow 0$ of the KD $^1\Sigma \rightarrow {}^1\Sigma$ system were found and analysed. At this dispersion, overlapped lines are still numerous and reach up to half the number of lines (60–80) in each band.

The rotational functions of both upper and lower states are anomalous in having a maximum in $\triangle_2 T_r/4J + 2$ at about $J = 20$, and $T_r(v,J)$ must be expressed by terms with positive D_v, negative F_v, etc. However, this point should be examined with a larger dispersion, and preliminary values of rotational constants were calculated according to the usual three-term formula adjusted to the $J > 20$ regions. B'_v can be given by $B'_v = 0{\cdot}673_7 + 0{\cdot}00391\,(v'+1/2) - 0{\cdot}000281\,(v'+1/2)^2$ within $\pm\ 0{\cdot}005$, $D'_e = -\ 1{\cdot}4 \times 10^{-5}$, and $B''_0 = 1{\cdot}641$, $D''_0 = -\ 1{\cdot}8 \times 10^{-5}$.

As the result of vibrational analysis, null-lines of the observed fourteen bands, evaluated from small

	KD upper state	KH upper state	ϱ^2
ω_e'	180·26	254·5 (Almy and House[1]) 240·18 (Hori)	0·5017 0·5633
B_e'	0·673,	1·344 (Almy and House) 1·311 (Hori)	0·5013 0·5139
		Theoretical	0·5129

J lines to minimize the possible errors in computing rotational energies, can be expressed by

$$\nu_o^{v'},0 = 19{,}229 + 180{\cdot}26\,(v'+1/2) + 2{\cdot}204_3\,(v'+1/2)^2 - 0{\cdot}05281\,(v'+1/2)^3,$$

within $\pm$ 2 cm.$^{-1}$. Here again the vibrational function $G'(v)$ is characterized by positive x_e. From the above given constants the isotope coefficient ϱ comes out as indicated in the table.

Further analysis of the system is under way and will be published in the *Scientific Papers* of this Institute.

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[1] Almy, G. M., and House, C. D., *Phys. Rev.*, **42**, 243 (1932).
[2] Hori, T., *Mem. Ryojun Col. Eng.*, **6**, 1 (1933).

Points from Foregoing Letters

THE movable 'thumb' of the giant panda, which it uses for the purpose of grasping bamboo shoots, is not a true first digit, writes Prof. F. Wood Jones. The actual thumb of the panda, as of all animals which use all four limbs for supporting the body on the ground, has lost its movability and the animal has developed a new movable digit, rather than reverse its structural evolution (Dollo's law).

A modified method for determining the electronic charge on an oil droplet is described by Prof. T. H. Laby and V. D. Hopper. A horizontal electric field is employed and the movement of the droplet is recorded photographically, so that a displacement of 3×10^{-5} cm. can be measured. Experiments of a preliminary nature indicate for the electronic charge a value slightly lower than that found by Millikan.

Sir James Jeans criticizes the assumptions of Gamow and Teller in their discussion of the genesis of the great nebulæ. He concludes that the universe as it now stands could be formed by the condensation of a gas with a 'thermal' velocity of about 20 km./sec., that is, from a mixture of atoms and electrons at any temperature between — 260° and 19,000° C.

The volume of extra-cellular fluid in various organs has been calculated by Dr. J. H. E. Griffiths and Dr. B. M. Maegraith from determinations of the radioactivity of blood and tissues of a rabbit after injection of radioactive sodium chloride—assuming that the sodium is mainly distributed outside the cells. They find, however, that a certain amount of radioactive sodium is absorbed by the cardiac muscles.

Dr. O. Mühlbock finds that diethylstilbœstrol, unlike the œstrogenic hormones, does not suppress the comb-growth action of the male hormone, progesterone.

Commenting on Dr. Duszyńska's observation that the response to œstrone in albino mice is three times as great in May as in November, E. V. Shute states that there appears to be a seasonal rhythm in the proportion of œstrogens found in normal males; also the blood œstrogens in pregnant women are greater in late winter and spring than in summer; this can be inversely correlated with the intake of vitamin E.

Dr. E. H. Vogelenzang finds that the addition of zinc decreases the iodine consumption of insulin. The magnitude of the zinc effect is a function of the physiological action of the insulin preparation, and the author believes that it may eventually serve as a basis for the chemical estimation of insulin activity.

Prof. B. N. Singh and J. D. Jha find that in the young leaves of the mango the assimilation rate of carbon dioxide increases continuously but not in proportion to the chlorophyll content. The behaviour is similar to that observed by Briggs in the case of seedlings where the storage organ is different from the first assimilating organ and the photosynthetic activity lags behind chlorophyll formation.

Observations on the movement of mature male parr in the Welsh Dee are reported by G. M. King, J. W. Jones and Prof. J. H. Orton, suggesting that at spawning time such movements can be different from those of other parr, and that upstream and downstream migration and positive chemotaxy may occur.

Rate of absorption of water vapour by wool fibres is rapid when the external restrictions of diffusion and thermal change due to heat of absorption are removed. It is suggested by Dr. A. B. D. Cassie, Dr. B. E. Atkins and G. King that this fact is of importance for the hygienic properties of textile fibres and the propagation of temperature changes through fabrics in ordinary indoor-outdoor atmospheres.

Photographs of the X-ray diffraction spectrum of annealed and of subsequently cold-rolled copper at different stages are submitted by W. A. Wood, showing a relative shift and diffusion of the (400) and (331) lines. These indicate a breakdown into small crystallites, followed by a partial recovery in internal deformation and overall size of crystallites.

By comparing the judgments of thirteen subjects concerning the relative softness of samples of bitumen with the actual viscosity of the samples, Dr. G. W. Scott Blair and Miss F. M. V. Coppen find an 80 per cent correct judgment for viscosity differences of 30 per cent.