

bombardment and have been very satisfactorily used in demountable vacuum apparatus.

Measurements of work function by the usual saturation emission method lead to a value for ϕ_0 about 1.8 eV. Retarding field values of ϕ lead to a value of about 2.8 eV. We interpret these results as meaning that the emission originates from an incomplete monolayer of barium ions, with about 70 per cent surface coverage. The temperature coefficient of the work function is about 1.4×10^{-4} eV. per deg. K.

A paper describing this work in more detail was read at the recent Congrès International du Cinquantenaire de la Cathode à Oxydes and will be published in the Proceedings of that Congress to appear in *Le Vide*.

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¹ Lemmens, Jansen and Loosjes, *Philips Tech. Rev.*, **11**, 341 (1950).

² Levi, Record of Inst. Radio Eng. Convention, 1953, Pt. 6, 40 (1953).

³ MacNair, Hannay and Lynch, *J. App. Phys.*, **24**, 1335 (1953).

Thermal Expansion of Grey Tin

No work appears to have been reported on the thermal expansion of grey tin and it may be of interest, therefore, to give some X-ray measurements that we have made on this material at temperatures between room temperature and -130° C. These are shown in Fig. 1, from which it will be seen that the coefficient of expansion is sensibly constant within the range quoted. The value actually works out to

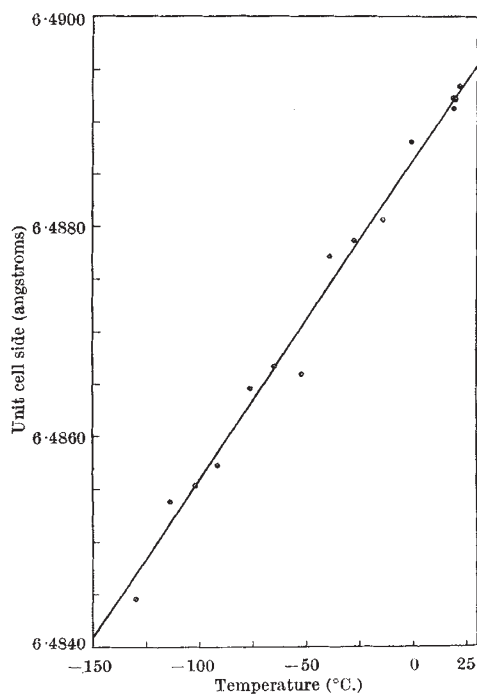


Fig. 1. Thermal expansion of grey tin

be 4.7×10^{-8} per degree C. The measurements were made with a 'Unicam' 19-cm. powder camera modified as described in a note to be published by us elsewhere. Unfiltered copper *K*-radiation was used.

The value of the unit-cell side, 6.4892 ± 0.0001 A. at 20° C. (assuming 1.54050 A. for the wave-length of copper *K* α_1), is significantly less than that reported by Brownlee¹, namely, 6.4912 ± 0.0005 A. However, the nature of our curve and the measurements actually made at room temperature (on two different specimens) suggest that our results are substantially correct, especially as the values of the lattice parameters of other materials obtained with the same camera under similar conditions are found to agree with the accepted values for these parameters within the experimental error claimed. We are informed by the Tin Research Institute, to which body we should like to express our thanks for supplying the tin, that the purity of the material we examined was 99.99 per cent, the main impurities being lead and antimony. These impurities would account at most for an error of about the same magnitude as our experimental error, and therefore the discrepancy is left unexplained.

Mr. J. T. Kendall, who supplied the tin used by Brownlee, has informed us that his sample was also very pure, being prepared from Johnson-Matthey's 'spectroscopically pure' material.

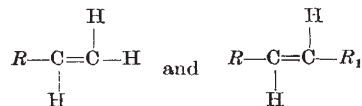
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¹ Brownlee, L. D. *Nature*, **166**, 482 (1950).

Infra-Red Assignments of Unsaturation in the Region 900–1,000 cm.⁻¹

THE region 900–1,000 cm.⁻¹ of the infra-red spectrum of organic molecules is useful for characterizing the type of unsaturation that may be present. This region is associated with the bending frequencies of hydrogen attached to an olefinic carbon. Thus the groups



give rise to characteristic bands at 909–916 cm.⁻¹ and 964–979 cm.⁻¹ respectively¹.

Recent work by Jackson *et al.*² and Privett *et al.*³ on the linoleates has enabled further assignments to be made in this region. *Trans-trans* conjugation is characterized by an absorption band at 988 cm.⁻¹, whereas *cis-trans* conjugation is characterized by absorption bands at 948 and 982 cm.⁻¹. However, when the spectrum of all *trans* vitamin A (which has five conjugated double bonds) is examined, there is one very strong band in the region 900–1,000 cm.⁻¹, but this lies at 968 cm.⁻¹, a position which is normally held to characterize only an isolated *trans* unsaturated bond. This is illustrated in Fig. 1, which shows the infra-red absorption spectrum of vitamin A palmitate, the 968 cm.⁻¹ band being characteristic of both the free alcohol and of its esters. The spectrum of β -carotene, which is a precursor of vitamin A and contains eight conjugated double bonds, is also similar in this respect.