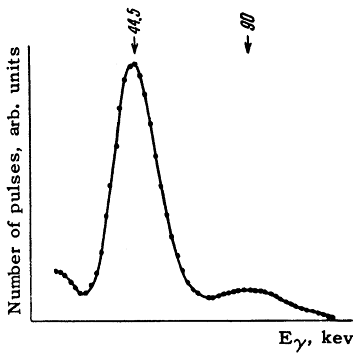

FIG. 2. γ spectrum of Dy^{159} taken with a sum spectrometer.

50 mm, h = 20 mm). The pulse distribution is shown in Fig. 2. A computation of the efficiency from the areas of the main and sum peaks,[4] on the assumption that the latter is produced by the same number of 44.5-kev quanta in cascade, is in good agreement with the efficiency computed by an independent method.

Thus the deexcitation of the first excited state of Tb^{159} also occurs with emission of Tb K radiation, in view of the strong conversion of the 57.5-kev line. The conversion coefficient is $\geq 99\%$.

In conclusion the authors thank A. N. Murin and B. K. Preobrazhenskii for their preparation of the pure source.

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Translated by M. Hamermesh
163

STUDY OF γ-RAYS FROM As^{78} *DECAY*

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It is known that in the decay of As^{78} (T = 90 min) two groups of β^- particles are emitted (E_β = 4.1 Mev, 70% branch; E_β = 1.4 Mev, 30%). γ rays with energies of 0.27 Mev[1] and 0.615 Mev[2] are also observed in the decay. It is impossible, on the basis of the available data, to attempt even a decay scheme for this isotope.

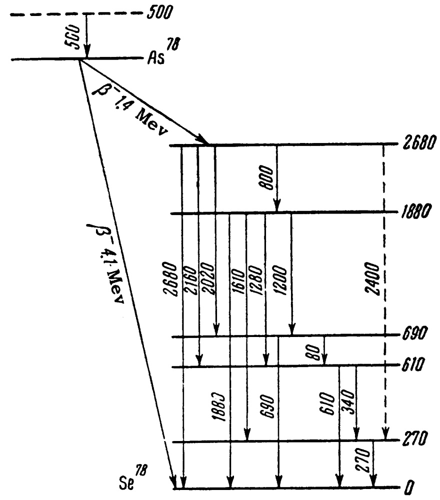
We obtained As^{78} from bombardment of separated Se^{78} isotope with 14-Mev neutrons, via the (np) reaction.

The measurements were carried out on a scintillation spectrometer with a 128-channel analyzer.[3] We used the geometry of the standard single-crystal spectrometer (with FEU-S photomultiplier and a NaI (Tl) crystal, diameter 30 mm, h = 40 mm), and the geometry of a 4π summing spectrometer (FEU-13 with CsI (Tl) crystal, diameter 50 mm, h $\doteq$ 40 mm).

The following γ lines were observed in the singles spectrometer geometry: 500 kev with T = 5 to 6 min; γ lines with T = 90 ± 10 min: 270, 610, 800, 1280, 2680 kev (all intense lines), 80, 345, 690, 1200, 1620, 1880, 2020, and 2160 kev (weak lines). There was a suspicion of the existence of a line with very low intensity at ~ 2400 kev.

In the summing spectrometer geometry, the following sum lines were definitely observed (all with period 90 ± 10 min): 420, 2700, and 1650 kev. The transitions with a period of 90 min can be assigned to the $As^{78} \rightarrow Se^{78}$ β^- decay.

The γ line at 500 kev (T = 5 to 6 min) is interesting. It is not the result of annihilation of positrons from some β^+ decay, since careful measurements with the summing spectrometer showed no sum line at E_γ = 1 Mev. We also observed no other γ lines with T = 5 to 6 min. This suggests that this line is the result of deexcitation of some metastable state which is formed in the interaction of neutrons with Se^{78}



Decay Scheme of As^{78}.

(since this line was not found in experiments with other separated isotopes of Se).

Running through the other possible reactions on Se^{78} (n2n, n2p, nα, npn), one finds that the isomers of products of such reactions have been well investigated and that no isomer has been found which has the observed state ($T = 5$ to 6 min; $E = 500$ kev). We can therefore assume that As^{78} has a metastable state with an energy of 500 kev.

A possible decay scheme for As^{78} is shown in the figure.

In conclusion, the authors thank A. N. Protopopov and his colleagues for neutron irradiation of the samples.

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Translated by M. Hamermesh
164

LOW TEMPERATURE POLYMORPHISM OF METALS

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THE existence of a so-called low-temperature modification of tin (α-Sn), stable below 18°C, is well known. Spontaneous transformation of white tin into gray, however, does not occur in practice even upon substantial holding times at low temperatures. It can be brought about by means of plastic deformation at temperatures below the transformation point.[1]

Works of recent years have established the existence of low-temperature allotropic transformations which proceed also in lithium and sodium[2,3] upon plastic deformation under conditions of strong supercooling. One can surmise that this phenomenon is characteristic of many non-close-packed metals. At the same time, on account of the small diffusion mobility of the atoms, there is practically no reorganization of the lattice into a new more dense structure stable at low temperatures. Plastic deformation facilitates the process, helping surmount the activation barrier.

In contrast to the preceding investigations, we used in the present work a method of mechanical tests, which consisted of studying the compression diagrams of specimens of lithium, sodium, cesium, bismuth, and beryllium with subsequent warming and registration of the volume changes during the reverse transformation. The bismuth and beryllium were monocrystals of 99.98% purity; the lithium, sodium, and cesium were chemically-pure polycrystals. The tests were run on a one-ton machine with a stiff dynamometer, adapted for measurements at helium temperatures.[4,5] The rate of deformation was constant at 0.03 mm/sec. The deformation and warming curves were recorded on photographic film.

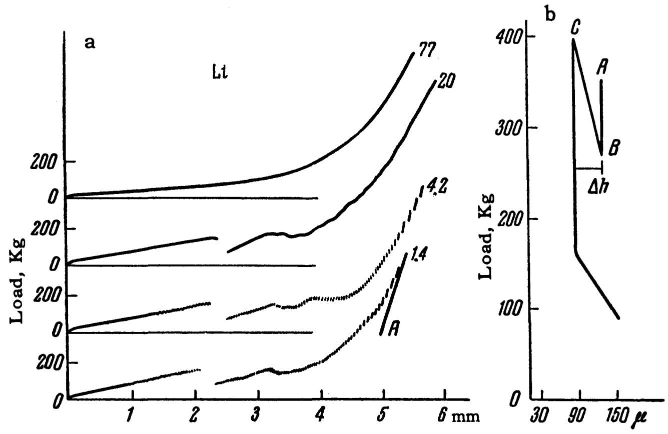

FIG. 1. a – Machine compression diagrams for specimens of chemically pure lithium at temperatures from 77 to 1.4°K; b – Dilatometric curve taken during warming of the lithium specimen deformed at a temperature of 1.4°K.

A typical deformation diagram in "load vs. absolute compression" coordinates is shown in Fig. 1a for lithium (the polymorphic transformation of which has been well studied by x-rays[2,3]). At 77°K it is a smooth curve with a hardening shape at high degrees of reduction, without any singular points indicative of the occurrence of a transformation. It should be noted here, however, that x-ray investigations under these conditions recorded a partial transformation from body-centered cubic modification to face-centered. On reducing the deformation temperature to 20°K and lower (down to 1.4°K), a characteristic disruption appears on the curve with a sharp drop in resistance to deformation, in response to allotropic transformation in a considerable portion of the volume of the deformed metal.*