spectra of the irradiated crystals suggest the formation of some kind of molecule which can "react" under the influence of higher temperature or optical excitation to form complexes with halide ions and therefore $V_{2,3}$ centers.

The analysis at the present state glosses over certain differences (e.g., between x-rayed and additively colored crystals) in order to point out similarities; it is hoped to extend these results so that they may form an adequate basis for explaining the more intimate details of V centers.

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Elastoresistance Constants of *p*-Type InSb at 77°K*

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(Received December 20, 1956)

A PRELIMINARY experiment has been carried out to measure the elastoresistance constants of single-crystal specimens of *p*-type InSb at 77°K. The experimental arrangement used is similar to that employed by Smith,[1] whose notation and terminology are used below in reporting the data.

A zone-refined single-crystal ingot of InSb was obtained from the Chicago Midway Laboratory through the courtesy of its semiconductor group. A Hall measurement at 77°K gave a hole concentration of 3×10^{15} cm^{-3}. Samples were cut from the oriented ingot in the form of rectangular rods of approximate dimensions 30 mm×2 mm×2 mm. The nominal resistivity of the samples at 77°K is 0.5 ohm-cm.

The piezoresistance constants Π_{11}, Π_{12}, and Π_{44} were determined by observing the effect of hydrostatic pressure and tensile stress on the "longitudinal"[1] resistivity of two sets of four samples whose long dimensions were either along the [110] or [111] direction. The order of magnitude of the tensile stress was 10^7 dynes/cm^2; that of the pressure, 150 atmospheres. The elastoresistance constants, relating the resistivity change to the strain, are obtained from Π_{11}, Π_{12}, Π_{44}, and the elastic constants.[2,3] Table I gives the piezo- and elastoresistance constants at 77°K.

In the notation of Dresselhaus,[4] for the case of a "simple many-valley" semiconductor,[5] we may draw the following conclusions about the position of the energy extrema from these results:

Table I. Piezo- and elastoresistance constants of InSb at 77°K.

Π_{11} (cm^2/dyne)	$(98\pm\ 7)\times10^{-12}$	m_{11}	32 ± 5
Π_{12} (cm^2/dyne)	$(-49\pm\ 6)\times10^{-12}$	m_{12}	-16 ± 2
Π_{44} (cm^2/dyne)	$(435\pm12)\times10^{-12}$	m_{44}	137 ± 4

(1) The point Γ, $K=\langle000\rangle$, with doubly degenerate, spherical energy surfaces (Γ_6 or Γ_7), is ruled out since the elastoresistance is large.

(2) Points on the Λ or $\langle111\rangle$ axes are ruled out since $m_{11}\neq m_{12}$.

(3) The points W, $\mathbf{K}=(2\pi/a)\langle10\tfrac{1}{2}\rangle$, and points on the $\langle100\rangle$ axes are ruled out since m_{44} is large.

The energy band calculations of Dresselhaus[4] suggest the points Γ, Λ, W, and a general point in the Brillouin zone as likely points for the occurrence of the extrema. In view of the above conclusions, nondegenerate energy surfaces at a general point in the zone, or fourfold-degenerate surfaces at Γ (Γ_8), remain as possibilities for the *p*-type InSb investigated

Additional experiments measuring the piezoresistance constants of several samples of both n and p types of InSb of different resistivities are now in progress. A preliminary measurement of the temperature dependence of these constants has been completed; more refined measurements will be reported in detail in the near future.

* This work was supported in part by the Office of Naval Research.
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Moving Striations

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MOVING striations have usually been investigated by one only of the following methods: (1) observations, such as Zaitsev's,[1] of appearance; (2) use of Langmuir probes, with a cathode-ray oscilloscope[2,3]; (3) optical studies, initially by rotating mirrors, more recently by photomultiplier tubes.[4,3]

In an investigation in progress here, measurement of all these types is being made simultaneously, in a tube of 2-cm radius with three fine probes fixed at the axis and a fourth capable of transverse motion. Anode and cathode are also movable.

Striations are observed by a photomultiplier moving along the discharge tube. A dual beam oscilloscope displays simultaneously two instantaneous quantities, e.g., light intensity, probe current. Striation speeds are measured by phase changes of the photographed traces as the photomultiplier is moved. Although the analysis of data is not yet complete, certain results have already emerged which seem worth reporting now.

From analysis of data taken with 13.5 ma passing through neon, the following results have been found:

(a) At 2-mm pressure there is some evidence for fast negative striations near the head of the positive column. These only appear at intensity minima, as in argon.[5] At 4.8-mm pressure no negative striations have been found.

(b) Positive striations with speeds from 25 to 500 m/sec were found consistently in the positive column. Variations in velocity occur near anode, probes, and the head of the column.

(c) An increase in brightness occurs near the anode side of a probe. Whatever its origin, it introduces a new uncertainty in assessing probe measurements.

(d) Probe measurements in the positive column indicate Maxwellian electron energy distributions. Temperatures vary between 28 000°K and 50 000°K at 2 mm pressure, and 21 000°K and 40 000°K at 4.8 mm. Electron concentrations vary between 7×10^8 and 3×10^9/cc (2 mm) and 1.9×10^9 and 4.3×10^9 cc (4.8 mm).

(e) Field intensity at a typical point in the column varies between −12 and 4.5 v/cm at 2.0 mm, and −7 and 14 v/cm at 4.8 mm.

(f) Nowhere in the column does the light intensity fall to zero. This confirms previous results for argon.[6,7]

(g) Oscillations can be detected with probes several cm inside the Faraday dark space, measuring relative to either anode or cathode.

(h) The phase of voltage at which striations leave the anode depends on anode-cathode distance, in disagreement with Donahue and Dieke's results for argon.[4]

(i) Oscillation frequency depends on anode-cathode distance, with a roughly sinusoidal variation.[1] However, cathode movement caused greater change than anode movement, suggesting that tube geometry is significant. Typical variations are 1260 to 1560 cps (2.0 mm), and 1125 to 1350 cps (4.8 mm).

(j) Amplitude of voltage oscillations across the tube varies in a more complex periodic manner with anode-cathode distance. Amplitudes of 5 to 20 v occur.

The over-all picture remains one of great complication, and our experiments indicate that the oscillatory properties are determined by conditions near both anode and cathode.

We wish to thank Professor K. G. Emeleus for his interest in the work.

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Properties of Fermium-253

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(Received December 21, 1956)

THE isotope fermium-253 was identified and measured among the products of the reaction of californium-252 with 40-Mev alpha particles. A target of 2.5×10^{12} atoms of Cf^{252} was prepared by electroplating the californium on a 0.002-inch gold disk. The californium was produced from Pu^{239} by successive neutron captures and beta decays.[1] It contained also Cf^{249}, Cf^{250}, and Cf^{251}. The target was irradiated with an effective beam of 1 microampere of alpha particles for 11 hours at the 60-inch cyclotron of the Crocker Laboratory. The products of the reaction were collected on a thin gold catcher foil by a recoil technique previously described.[2] The fermium fraction was separated by using precipitation and ion-exchange techniques,[3] and was electroplated on a 0.001-inch platinum disk. The alpha energy spectrum was measured in an ionization-grid-chamber with a 48-channel alpha pulse-height analyzer. Figure 1 represents a characteristic pulse analysis four days after the end of the bombardment. The main fermium activity in the first days of measurement was due to 30-hr Fm^{252} of 7.04±0.02 Mev alphas, being produced by the $Cf^{252}(\alpha,4n)$ reaction. The decay of the 6.94±0.04 Mev peak of Fm^{253} was followed by a corresponding growth of a 6.64±0.03 Mev peak of E^{253}. The alpha-particle energy emitted by the Fm^{253} was found in the range of 6.90–6.98 Mev. An earlier experiment carried out in this laboratory gave the same results. The growth of E^{253} was found to result from the decay of Fm^{253} with a 4.5±1.0 day half-life. Thus, the Fm^{253} is the longest lived fermium isotope known; only the undiscovered Fm^{257} is expected to have a longer half-life. The activity of Fm^{253} produced at the end of the bombardment was 0.77 disintegration per minute.

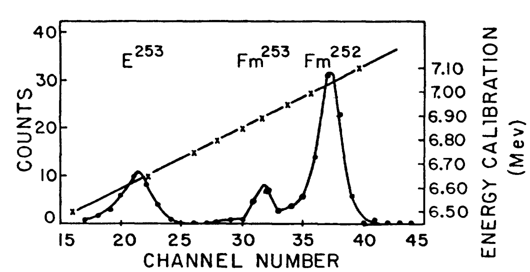

Fig. 1. Alpha spectrum of fermium fraction after 4 days.