angular momentum of the excited level in Li^7 is $\frac{1}{2}$, rather than 5/2 as suggested by Hanna and Inglis.[5]

The angular distribution of the alpha-particles from the reaction $Li^6(d,\alpha)He^4$ has also been determined for deuteron energies between 200 kev and 1 Mev. The distribution is of the form

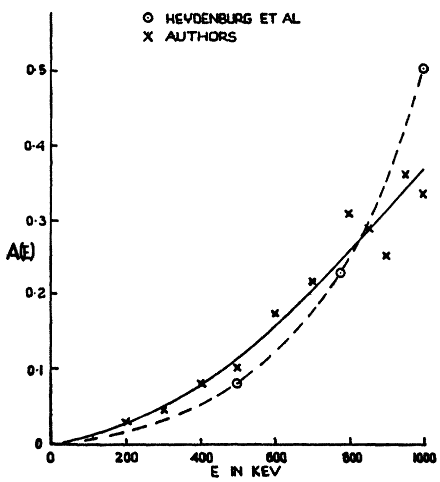

FIG. 2. Variation with energy of the asymmetry in the angular distribution of alpha-particles from the $Li^6(d,\alpha)He^4$ reaction.

$1+A(E)\cos^2\theta$, and the variation of $A(E)$ with energy shown in Fig. 2 confirms the earlier results of Heydenburg *et al.*[4]

A full description of the investigation will appear in the *Australian Journal of Scientific Research.*

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Electric Forming in *n*-Germanium Transistors Using Phosphorus-Alloy Contacts

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THE use of temporary large currents through the collector contact of *n*-type transistors to produce permanent improvements in performance has been reported by Bardeen and Brattain.[1] During this forming operation, the role of the contact material, which was stated to be phosphor bronze, was not particularly indicated. Very recently, Pfann[2] has submitted data on the effect of the presence of antimony in the contact material when the contact is electrically formed. With increasing concentration of antimony, a donor impurity, an increase in γ, the current gain, was noted.

TABLE I. Pulsing response in transistors to equal pulses applied to collector using phosphorus-alloy collector contacts. Average gain before pulsing = 10 db.

Alloy	Weight % phosphorus	Average power gain after pulsing (db)	Power gain range after pulsing (db)
OFHC Cu (Pure)	0.00	10.5	9–12
No. 3	0.03	17	15–24
No. 5	0.9	24	23–26
No. 7	1.1	25	22–28
Commercial phosphor bronze	0.1	21	20–24

Some time ago it was suggested by Mr. L. E. Barton, of RCA Laboratories that the phosphorus content of the collector contact point played an important role in improving transistor gain, when pulse forming was used. Barton's experimental data were of a preliminary kind; the present letter presents more convincing evidence of this hypothesis by tests with specially prepared alloys.

Table I summarizes results obtained with electrical forming of collector contacts containing varying amounts of phosphorus. Average results and range values are given for five transistors in each group in which the collector contact consisted of the copper alloy shown, with emitters of phosphor bronze being the same in all cases.

The response to equal forming pulses is presented as the improvement in power gain from an average of 10 db as measured at 5 kilocycles in class *A* amplifier operation. An increase in power gain in all cases was accompanied by an increase in the current gain γ, and in collector current. For comparison, the results obtained with relatively pure OFHC copper and a commercially available phosphor bronze are included. Pulsing response increases rapidly with phosphorus content up to a concentration of about 0.1 percent, beyond which there follows a more gradual rise to what may be a limit.

In another series of experiments, in which phosphor bronze was used for both emitter and collector contacts, the effect of direction of voltage pulse was investigated. In Table II are shown the results of pulsing under the various conditions; the values for each line are the average for five transistors.

TABLE II. Transistor pulsing response under various conditions of pulsing. Average gain before pulsing = 10 db.

Collector pulsing voltage	Emitter bias voltage during pulsing	Average power gain after pulsing (db)	Power gain range after pulsing (db)
−180 (reverse direction)	0	23	19–24
+22 (forward direction)	0	24	21–25
−90 (reverse direction)	+0.4	22	20–25

As the data show, it has been possible to obtain equivalent effects with voltage pulse in the forward and in the reverse direction; the voltage required in the forward direction is considerably lower since the resistance is also lower in this direction. In both of these cases, the improvement in power gain was accompanied by an increase in reverse current of the pulsed contact, apparently in disagreement with the conclusions of Bardeen and Pfann[3] as to the effect of direction of forming. It has also been observed that the pulsing voltage required to obtain a forming effect is smaller if a positive emitter bias is maintained during forming. This observation is plausible when the effect of positive emitter bias on collector impedance is considered.

In view of these results, pulsing response appears to increase with phosphorus concentration in the contact material and with pulse power input, and, as such, is a function of the heat generated at the point contact. Some fusion at the metal-germanium junction is observable under a microscope after successful forming. A superficial diffusion of phosphorus, or other donor, into the germanium surface under the contact point may account for the change in the height of the potential barrier observed to give increased power and current gain.

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