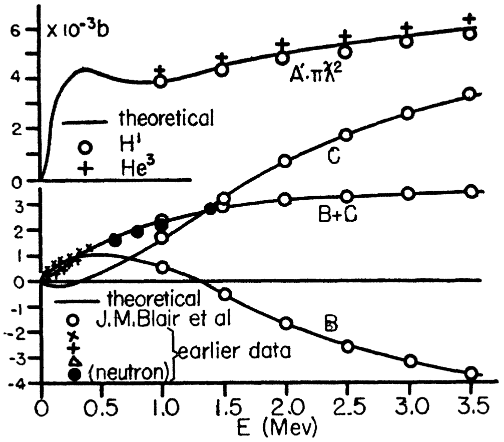

FIG. 1. Isotropic cross section $A'\cdot\pi\lambda\!\!\!^{-2}$ and anisotropic coefficients B and C as functions of the energy of the incident deuteron.

as the theoretical curve of Konopinski and Teller, as shown in Fig. 1. The vanishing of C at *ca.* 0.3 Mev corresponds to Blair's statement that it happens between 0.5 and 1.0 Mev. It should be added that the above numerical values give the correct signs and the reasonable orders of magnitude for all $\alpha_{l,m}$'s.

The author wishes to thank Professor K. Umeda for his advice and encouragement.

[1] E. J. Konopinski and E. Teller, Phys. Rev. **73**, 822 (1948).
[2] Blair, Freier, Lampi, Sleator, and Williams, Phys. Rev. **74**, 1599 (1948).
[3] The full expressions will be given shortly in J. Faculty Sci. Hokkaidô University, Sapporo, Japan.
[4] H. A. Bethe, Rev. Mod. Phys. **9**, 178 (1937).

Current Densities in the Cathode Spots of Transient Arcs

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IT has recently been suggested that the current densities of arc cathode spots may exceed hitherto accepted values by at least an order of magnitude. From observations of the tracks left by rapidly moving cathode spots on oxidized metal surfaces, Cobine and Gallagher[1] derived current densities of the order of 5×10^4 amp./cm². Using a Kerr cell shutter and exposures of the order of a microsecond to photograph the cathode spot, Froome[2] obtained current densities of about 10^6 amp/cm².

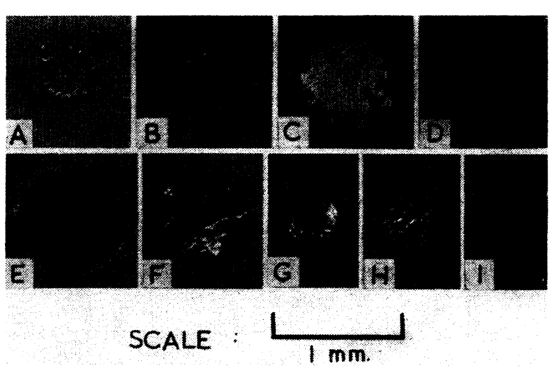

FIG. 1. Cathode markings for high current transient arcs in air at atmospheric pressure.
Top.—Cathode material: (A) copper; (B) magnesium; (C) aluminium; (D) nickel. Current: 80 amperes. Duration: 20 μsec.
Bottom.—Cathode material: Tin. Current: 50 amperes. Duration: (E) 200 μsec.; (F) 50 μsec.; (G) 20 μsec.; (H) 5 μsec.; (I) 1 μsec.

We have struck high current arcs of short duration in air at atmospheric pressure on aluminum, copper, magnesium, nickel, tin, and tungsten cathodes. Using a number of pulse-forming lines, we could pass currents of up to 200 amperes in square pulses varying in duration from 1 to 200 microseconds.

The arc strikes readily and leaves a clear, well-defined spot on clean tin, on aluminium which has not recently been scraped clean, and on oxidized copper, nickel, magnesium, and tungsten cathodes. The spots are roughly circular in shape, some typical examples being shown in Fig. 1. A single pulse usually gives a single spot although cases of multiple spot formation occur in aluminium, copper, and tungsten, particularly at high currents. Measured areas of spots obtained with the same current and pulse length vary about the mean with a standard deviation of 0.05 to 0.1 of the mean.

For a given pulse length the mean spot area is proportional to the current strength and so for each metal the ratio (current/spot area), which we may call the apparent current density, is a function of the pulse length. In all cases the apparent current density increases as the pulse length falls, as shown in Table I.

TABLE I. Current density (amp/cm²).

Pulse length	1 μsec.	5 μsec.	20 μsec.	50 μsec.	200 μsec.
Aluminium	160,000	65,000	40,000	40,000	Unreliable
Copper	780,000	390,000	114,000	90,000	35,000
Magnesium	$>10^6$	1,000,000	320,000	140,000	35,000
Nickel	480,000	175,000	67,000	56,000	18,000
Tin	340,000	33,000	19,000	19,000	9000
Tungsten	1,600,000	340,000	75,000	22,000	Unreliable

Our experiments are in agreement with those of Froome is indicating that, in arcs of short duration at least, current densities of the order of 10^6 amp/cm² may prevail. It is possible, of course, that the markings on our cathodes for longer pulse lengths are the result of the motion of one or more smaller spots like those observed by Froome, but our experiments give no information about this. It may also happen that, particularly in the case of the lower melting point metals, an area is melted greater than the area from which the current is drawn, leading to low apparent current densities. For these reasons we regard our measurements as giving only a lower limit to the real current density.

[1] J. D. Cobine and C. J. Gallagher, Phys. Rev. **74**, 1524 (1948).
[2] K. D. Froome, Proc. Phys. Soc. **60**, 424 (1948).

The Beta-Spectrum of Tl^{204}, Magic Numbers, and Neutron Pairing

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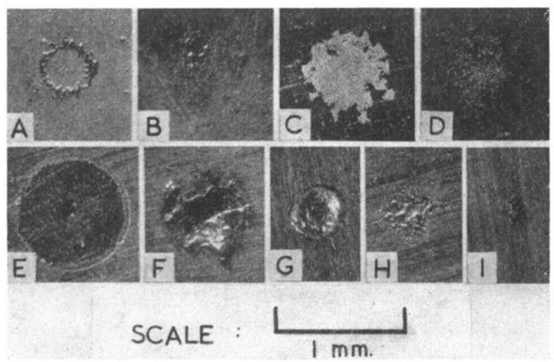
August 16, 1949

THE β-spectrum of the 3 yr. Tl^{204} is of special interest because the nuclei involved lie close to the magic numbers 82 for protons and 126 for neutrons.[1] According to the most recent nuclear shell work,[2] Tl^{204} may be useful in deciding whether high angular momentum neutrons are added in pairs in the heavy element region. Both the neighboring isotopes Tl^{203} and Tl^{205} have the low spin $\frac{1}{2}$, while the daughter substance Pb^{204} probably has spin 0. Therefore the shape of the β-spectrum of Tl^{204} will give strong evidence for or against the high angular momentum neutron pairing.



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