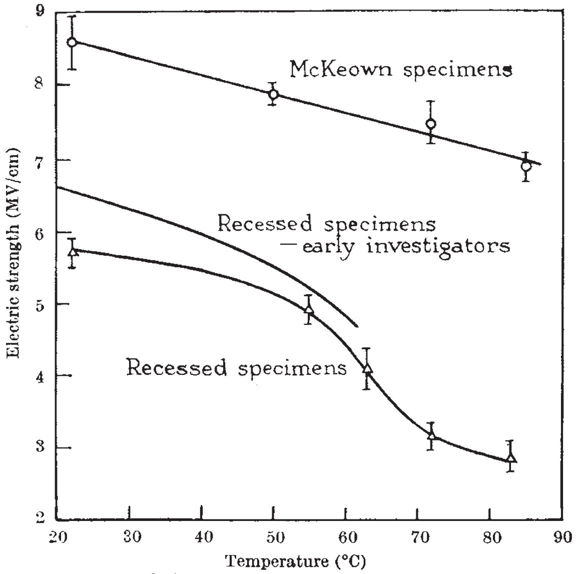

Fig. 2. Change of electric strength with temperature for polythene *M.F.I.7*. The plotted points are means for 6 to 10 specimens and 95 per cent confidence limits of the mean are shown

His technique consists of encapsulating a thin film of polythene between two polished steel spheres in a cured thermosetting epoxide resin (Fig. 1*a*). Using this technique McKeown reported a marked increase over earlier values for the 'intrinsic' electric strength of polythene at room temperature. Values in excess of 8 MV/cm were quoted, whereas the conventional recessed specimen (Fig. 1*b*) yields values around 6 MV/cm (refs. 2–4).

The results are shown graphically in Fig. 2, along with the curve obtained with recessed specimens. Also shown in Fig. 2 is a curve representing the mean results of four earlier investigations using recessed specimens of (probably purer) polythene. The low results given by the 'recessed' technique are not therefore confined either to the present work, or to the present sample of polythene. They are attributed partly to thermal failure and partly to electromechanical deformation. The latter is prevented, and the onset of the former postponed to higher temperatures, by the rigidity and good thermal conductivity of the McKeown arrangement. The polythene used in both cases was a low-density (0·919 g/cm³) material of melt flow index 7 and Vicat softening point 86° C. The specimens varied in thickness from 20 to 60μ.

Tests were carried out using a linearly rising direct voltage and breakdowns occurred in about 20 sec. The voltage was measured with a micro-ammeter in series with a 200-MΩ resistor.

The epoxide resin in the McKeown specimens was cured at a temperature higher than that selected for testing, but not less than 70° C. When the cure was complete the specimens were transferred quickly to a constant temperature oil-bath, where the thickness was measured using a dial gauge micrometer and where they were afterwards tested. A blank specimen containing no polythene was made with each batch of specimens and used to obtain a zero setting on the micrometer.

I have carried out subsidiary experiments, which show that the increase in electric strength, which appears at all temperatures from 20° C to 85° C, is not attributable to changes in the polythene introduced during specimen preparation.

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OCEANOGRAPHY

Rip Currents on a Cornish Beach

Rip currents have been measured at Holywell in West Cornwall, where a sandy beach is open to waves and swells from the Atlantic. A rip current is a narrow streak of water which flows seawards from the beach; it carries the return flow of the general shorewards transport of water produced by the breaking of waves. Such currents cause many bathing fatalities each year.

The currents were measured by observing the speed of floating objects, or of foam on the surface, by means of a theodolite mounted on an adjacent promontory. Speeds of almost 5 knots were observed when the incoming swell reached about 10 ft. in height and when there was a slight on-shore wind blowing. The rips were observed to travel out from the shore for as far as 900 ft.; it is quite possible that they travelled farther, but the situation of the observation post made greater distances difficult to measure.

Results under heavy swell were as follows; the measurements were of the mean speed over 1 min.

In the surf zone. Average of 7 measurements: 276 ft./min (maximum: 330 ft./min, minimum 209 ft./min).

Seaward of the surf zone. Average of 6 measurements: 143 ft./min (maximum: 209 ft./min, minimum 113 ft./min).

Holywell beach is probably typical of many beaches on the Atlantic coasts of Western Europe, so that it can reasonably be expected that rip currents of this magnitude will occur in many such places.

We thank the members of the Holywell Bay Surf Life-Saving Club for their assistance.

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METALLURGY

Reduction in Ductility of Austenitic Stainless Steel after Irradiation

Recently it has been established that the reduction in ductility of austenitic stainless steel in the temperature range 650°–850° C after neutron irradiation is caused primarily by the thermal neutrons[1,2]. The decrease in ductility occurs in the non-uniform portion of the stress–strain curves and the fracture is intergranular[2–5]. The elevated temperature ductility cannot be recovered even by annealing for 0·5 h at temperatures above 1,000° C (refs. 4 and 6). Furthermore, the magnitude of the effect is associated with the boron-10 content of the steel[7]. It appears most probable, therefore, that one or both of the products of boron-10 (nα) lithium-7 transmutation are responsible for this effect. A mechanism, based on the presence of helium at the grain boundaries, has been suggested[8] recently to explain the decrease in ductility and the tendency to intergranular fracture, and after some conditions of irradiation helium bubbles have been observed at the grain boundaries[9], using transmission electron microscope techniques. However, neither the relative nor additive effects on the elevated temperature ductility is known for such small amounts of helium and lithium as those formed by the thermal neutron transformation of the boron-10 isotope present in the steel.

We have irradiated 20 per cent chromium, 25 per cent nickel : niobium stabilized steel foils with α-particles and lithium ions respectively and determined the relative effect