Fig. 1. Estimated yield stresses

which were then solved using a value of 0·35 for Poisson's ratio to give solutions of a graphical form described by Davies[2]. For values of h ranging from 48 cm. to 2 cm. the values of dynamic yield stress obtained were $6·9 \times 10^8$–$3·1 \times 10^8$ dynes cm.$^{-2}$. A straight-line plot was obtained for dynamic yield stress against half the duration of contact, $t/2$, given by the Hertz calculation with the modulus $E_2 = 5·3 \times 10^{10}$ dynes cm.$^{-2}$. A typical set of results is shown in Fig. 1. Extrapolating the line to $t/2 = 0·2 \times 10^{-4}$ sec., which is approximately the time to reach maximum stress in the pressure-bar experiments[3,5], gave a yield stress of $16·9 \times 10^8$ dyne cm.$^{-2}$. Thus, assuming 'Perspex' behaves as a Hookean solid at pressure-bar rates of stressing, a yield stress of about $16·9 \times 10^8$ dynes cm.$^{-2}$ should be observed. The dynamic stress–strain curve of Kolsky[5] does not show this, but the more recent results of Davies and Hunter[3] show a linear stress–strain curve up to a yield stress of approximately $16·6 \times 10^8$ dynes cm.$^{-2}$. Thus the present simple technique may be of value in predicting high stress-rate behaviour.

A more detailed account of the above experiments for 'Perspex' and additional results for a number of other polymers will be published elsewhere.

JOHN ROBERTS

Ministry of Aviation
Explosives Research and
Development Establishment,
Materials Research Laboratories,
Waltham Abbey,
Essex.

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Packing of Spheres

IN connexion with Bernal's theory of liquids, Scott[1] has determined the packing density of equal spheres by experiments with steel balls. In this laboratory we were interested in the dense random packing of beads of ion-exchange resins. Although particles of ion-exchange resins may vary in diameter from 1·3 mm. to 0·03 mm. or less, if the ratio of the diameters of the larger to the smaller beads in any batch exceeds 3 or 4, segregation may occur when the beads are backwashed or allowed to settle under water.

If the ratio exceeded 6·5, it would be possible for the smallest spheres to fit into spaces between close-packed spheres of the largest diameter and so increase the packing density; but, if the problem is limited to the smaller ratios which occur in practice, only holes and not spaces can be filled by the smaller beads and the packing density should be 0·64–0·74.

The beads were sieved and packed under water, and to avoid peripheral errors at least 50,000 beads were taken for each determination. Narrow fractions with few irregular particles had packing densities close to 0·64. The value obtained for the most regular narrow fraction (irregular particles <4 per cent) was 0·63(8), in good agreement with Scott's extrapolated value of 0·63(7) for equal spheres. In this fraction the mean deviation from the mean diameter was 10·5 per cent. Wider fractions had increased packing densities, and a value of 0·66(7) was obtained for a fraction with mean deviation from the mean diameter of 23 per cent. Even higher values were obtained by mixing in various proportions beads of mean diameter 0·09 mm. with beads of mean diameter 0·31 mm. The smaller and larger beads alone each had packing densities of 0·66, but the packing density of the mixture reached a maximum of 0·70(5) when the proportion of the smaller beads was about 30 per cent of the mixture. Most batches of ion-exchange resin contain irregular fragments produced by the shattering of some of the beads, and these fragments probably affect the packing more than do rounded particles that are not truly spherical. The packing density of crushed resin was found to be 0·54 for particles of similar size. When various proportions of irregular particles were mixed with spheres of the same average size, the packing density remained at 0·64 until 10 per cent by intrinsic volume of irregular particles had been added. Thereafter the packing density decreased in proportion to the percentage of irregular particles in excess of 10 per cent.

J. R. PARRISH
National Chemical Research Laboratory,
South African Council for Scientific and Industrial
Research, Pretoria.

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GEOLOGY

Potassium–Argon Ages of the Dartmoor and Shap Granites using the Total Volume and Isotopic Dilution Techniques of Argon Measurement

EARLY in 1960, J. L. Kulp and others reported potassium–argon and rubidium–strontium ages for a number of granites from Great Britain and Eire[1]. The argon measurements were made at the Lamont Geological Observatory by the isotopic dilution technique, and the rubidium–strontium determinations were made at Oxford and Harwell. Some of the rocks examined, including the Shap and Dartmoor granites, had been measured by Mayne et al.[2], using the total volume technique for measuring the argon. There was a serious discrepancy between the potassium–argon measurements reported in these two communications, the results obtained by Kulp et al. being in agreement with the rubidium–strontium data (Table 2).

In this communication the results of new potassium–argon measurements on the Shap and Dartmoor granites, using both total volume and isotopic