fraujoch Laboratory, Switzerland, for further study of these new particles. Measurements of extensive showers with a very elaborate hodoscope are being started, and fundamental work on temperature and meteorological effects of cosmic rays is continuing.

Six research fellows are now working at the Clarendon Laboratory, Oxford, under Lord Cherwell, and the low-temperature department of the Laboratory has now been built up again; while in the small chemical laboratory of the Laboratory the use of chemical methods as an aid to exact methods in nuclear physics is being developed. At the Cavendish Laboratory, Cambridge, Dr. E. Orowan's group of research workers has developed a theory of low-temperature creep in metals and a photo-elastic method of recording the distribution of roll-pressure over the area of contact, and have investigated a new mechanism of recrystallization in cold-worked metals. In the investigation at the University of Cambridge into the mechanical properties of soil, the study of soil dynamics has centred largely on the improvement of the oscillograph apparatus for the simultaneous recording of the component soil forces on the tillage implement. A theory of the relation between the permeability of a structured material such as soil and its pore-size distribution has been checked by observation on the permeability over a wide range of moisture contents.

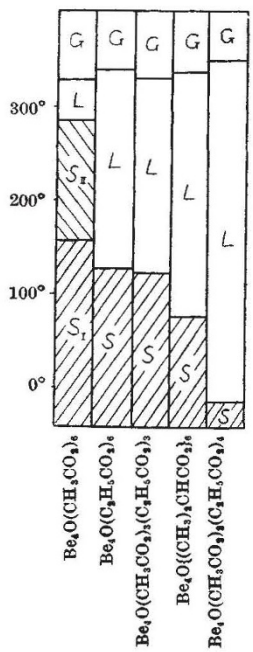
New grants in the social sciences have been made to the Department of Social Science, University of Liverpool (£7,000 over five years), for a study of group relations and an investigation into social factors of town planning; to the Social Research Division of the London School of Economics and Political Science (£20,000 over five years) towards a comprehensive study of social selection and differentiation with particular reference to the middle class; and to the Institute of Psychiatry, University of London (£20,000 over ten years), for a long-term investigation of the traditional methods of selecting students in comparison with a procedure using various psychological tests, and relation of the assessment with the subsequent careers of the individuals tested. A further grant of £1,000 to the National Institute of Economic and Social Research is to be used in support of the project, "Lessons of the British War Economy". Substantial starts are reported by the recipients of grants approved last year; the Administrative Staff College has commenced its activities, and the Population Investigation Committee has launched a large-scale field study of the trend of intelligence.

Steady progress is reported towards the realization of the Foundation's fellowship policy of a two-way traffic between the various parts of the Commonwealth and Empire of students of varying seniority and fields of interest. The Dominion medical travelling fellowships scheme has proved so successful that it is being continued, with slight modifications, for a further seven years; and the small scheme to enable practical farmers of England and Wales to study modern farming methods abroad has been extended to Scottish farmers. For medical men in the outlying parts of the African Colonies, the Foundation has made a grant of £30,000 to finance for six years periodic visits by a panel of medical consultants from Britain. Reference has already been made to the grant of £500,000 to the new National Corporation for the Care of Old People. The Foundation's own policy is to continue financial support to this Corporation, but, in conformity with its own interests in the problems of health, it will consider projects of research into causes of ageing. The report pays a tribute to Dr. J. H. Sheldon's report on "The Social Medicine of Old Age", although the publication falls just outside the year under review. Among the miscellaneous grants of the year is £1,000 a year for five years towards the maintenance and extension of the activities of the Universities Bureau of the British Empire (now the Association of Universities of the British Commonwealth).

POLYMORPHISM OF BERYLLIUM OXYACETATE

WE have found a transition of beryllium oxyacetate hitherto unrecorded. The transition occurs at about 160° C., and when the temperature is raised above this point the substance assumes gradually the appearance of soft wax, though it melts sharply at 285° C. The melting point of this substance is abnormally high as compared with those of other members of the homologous series, as is seen in the figure. It suggests that the high-temperature phase has some unusual structure in which the molecules are held together, forming a crystal lattice, but presumably with a higher order of freedom in its molecular motion, thus resembling the melt in its molecular state. This view is supported by the fact that the intensities of X-ray spectra taken with this phase fall off rapidly with increase of diffraction angles.

The configuration and symmetry of the molecule of this substance seem to fulfil the requirements put forward by Timmermans[1] for substances which give the so-called 'plastic crystals'. In fact, beryllium oxyacetate above the transition temperature much resembles in appearance the high-temperature modifications of pentaerythritol[2], tetranitromethane[3], cyclohexanol[4], etc., which are examples of plastic crystals.



The X-ray powder photographs taken with this substance slightly above the transition temperature and somewhat below the melting point are similar, but the relative intensities are not the same. Most of the lines observed can be accounted for as the lattice has a rhombohedral unit with dimensions $a_r = 9{\cdot}72$ kX., $\alpha = 54°\ 20'$, containing one molecule in it (copper $K\alpha$ radiation was used). The arrangement of molecules may be such that the centres of molecules occupy the rhombohedral lattice points; but the existence of a few lines which cannot be accounted for with this unit shows that the translation of the structure is not exactly rhombohedral but one having a lower symmetry.

It has been reported by Preston and Trotter[5] and by Beevers[6] that the symmetry of the Laue photographs of the cubic oxyacetate changes from $T_h - m3$ to $O_h - m3m$ in the interval 30–50° C. Jaffray[7] made a thermal analysis and found that at 40·5 ± 0·5° C. there is a change in the heat capacity curve typical of the λ-type. According to Beevers, this change is due to a change in the parameter values of the carboxyl oxygen atom from (−0·17, −0·06, −0·04) to (−0·17, −0·05, −0·05), as the temperature passes the transition range, thus bringing all the oxygen atoms exactly to the (110) planes. We have re-examined the substance by the Laue photographic method and found that the holohedral symmetry is first attained at 60° C. Moreover, we have found on the photographs taken with the X-ray beam perpendicular to the (111) planes a number of diffuse spots, the intensities of which are enhanced considerably on passing the transition temperature.

A tentative theory is put forward. The symmetry of the molecule in the low-temperature form is $T-23$, and the higher symmetry of the crystal $T_h - m3$ can be described as containing two kinds of molecules the mirror images of which are arranged regularly in accordance with the symmetry of the space group. If the packing of the molecules be kept as before but the two forms of the molecules be found at random, the symmetry of the crystal would attain the higher one $O_h - m3m$ in a statistical sense. This may be explained in another way as follows. The potential change associated with the rotation of the carboxyl group around the carbon-to-carbon bond parallel to the crystallographic axis would have a maximum when the oxygen atoms pass the (110) plane, and if the height of this barrier be low compared to the thermal energy, the oxygen atoms would pass over this barrier and arrive at another position of minimum energy which lies symmetrically to the (110) plane. This may transform the configuration of the molecule to its mirror image form if the change should occur simultaneously in six carboxyl groups within a molecule. Such may be the mechanism of the above-mentioned transformation.

Another modification of beryllium oxyacetate can be obtained by sublimation[8]. It is reported that this modification is birefringent and unstable at room temperature, transforming gradually when left by itself, or rapidly by grinding, into the cubic modification. The Laue rotating crystal and the moving-film goniometer photographs show that the crystal has a monoclinic unit with $a = 13{\cdot}75$ kX., $b = 9{\cdot}24$ kX., $c = 16{\cdot}21$ kX., $\alpha = 98°\ 55'$, $Z = 4$ (copper-Kα radiation was used throughout), and the corresponding space group is one of $C_s^1 - Pm$, $C_2^1 - P2$ or $C_{2h}^1 - P2/m$.

Detailed analyses of the structures of different modifications are now going on, and the results will be published later.

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July 15.

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We have carried out differential thermal analyses of beryllium oxyacetate in order to find accurate transition and melting points and also to examine the heat effect associated with these (Fig. 1). The

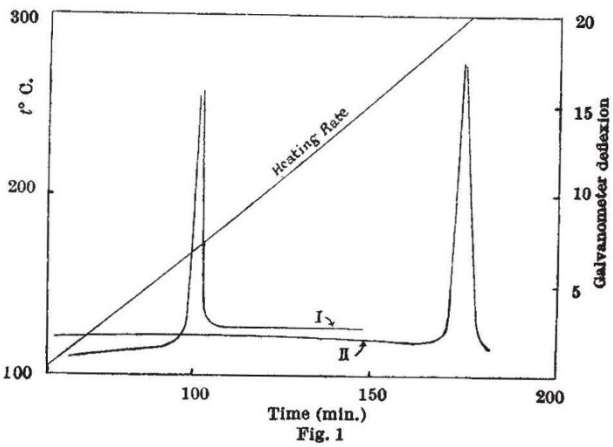

Fig. 1

observed transition and melting points are 148° C. and 286·7° C., respectively. If the sample is heated up to about 250° C. and then cooled to the room temperature, there is observed no transition phenomena in the cooling curve; this behaviour persists, for no transition phenomena is shown by the heating curve obtained on the next day (see curve II). But, when the sample is not heated beyond about 210° C., the transition in the heating curve made on the next day is always observed. The velocity of transition is accelerated by grinding the supercooled sample in an agate mortar. But this effect is somewhat complex. Details of the observation will be reported elsewhere. Comparison of the two peaks in the curves of the thermal analysis reveals that the heat of transition is nearly equal to the heat of fusion.

We have also made a dilatometric investigation. The results are shown in Fig. 2. It is found that the thermal expansion coefficient changes at four different temperatures, namely, 32° C., 42° C., 77° C and 124° C. At all these temperatures except the

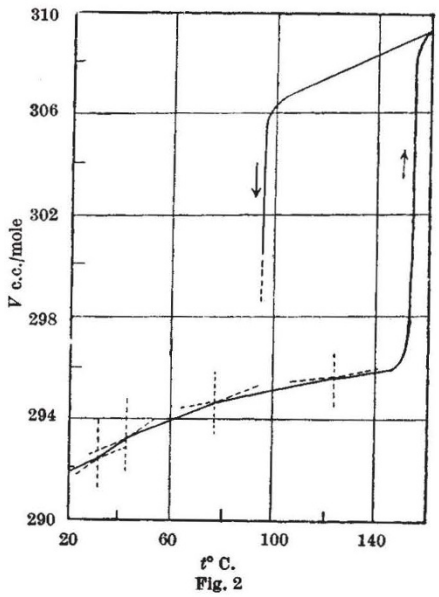

Fig. 2