

BRITISH RHEOLOGISTS' CLUB

Address for communications: c/o The Institute of Physics,
at The University,
Reading, Berks



Circular No.5

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Issued for the information
of members of the Club only

Meetings

The Club has met four times and the Committee eight times during the course of the year ending 31st October 1942.

Membership

It is encouraging to report that the membership figure now stands at 122. All who are "working or interested in Rheology and resident in the British Commonwealth" are welcomed as members.

The (American) Society of Rheology and Co-operation with other Allied Countries

The Honorary Secretary has received a most encouraging letter from Prof. H. Mark, President of the Society of Rheology, who says: "Please be assured that we all over here appreciate very highly your activities and efforts." The Honorary Secretary hopes, with the help of the Anglo-Soviet Scientific Collaboration Committee, to establish contact with Soviet Rheologists and to increase facilities for exchange of scientific papers and ideas.

The Institute of Physics

The Committee has conveyed to the Board of the Institute of Physics the Club's thanks for all the help and encouragement which it has received from the Institute. The Board of the Institute has offered a renewal of these facilities for a further year, and this has been gratefully accepted.

Invitation to Members from Road and Buildings Materials Group, Society of Chemical Industry.

The Honorary Secretary of this Group has been kind enough to convey to all members of the British Rheologists' Club an invitation to attend a lecture to be given on Wednesday, 4th November 1942, at No.1 Grosvenor Place, London S.W.1, by Dr. R.K. Schofield on "The Role of Moisture in Soil Mechanics".

Co-operation between Members

We now have members interested in a wide variety of subjects. The Honorary Secretary is always glad to hear from members of their interests and activities and will try to introduce them to one another when it seems likely that mutual help and co-operation can be effected.

The following list of materials gives some idea of the number of members who have expressed their interest in each of them: Blood 3; Cellulose and Paper 6; Ceramics and Clays 13; Coal 1; Concrete and Cement 1; Dairy Products 8; Emulsions 9; Flour 4; Foodstuffs (general) 8; Gas flow 1; Gels 2; Glass 2; Glue and Adhesives 5; Ink 8; Metals 10; Moulding Sands 2; Muscle 3; Oils and Greases 14; Paints, etc. 14; Pastes 4; Pharmaceutical products 4; Photographic materials 1; Plastics, etc. 16; Rubber 10; Soils, etc. 2; Starch 2; Tars, Bitumen, Road Surfaces, etc. 15.

Rheological Books and Papers

The Honorary Secretary has been sent a small number of books and papers, some directly as gifts to the Club and some others personally which he would be glad to consider as Club property. Those marked with an asterisk have been presented to the Club by the author. All may be borrowed by members on application:

*Ackermann A.S.E.

Physical Properties of Clay.

Society of Engineers. 5 papers dated 1919, 1920, 1921, 1922, 1923.

Höppler F. On the History of Viscometry (vid this Bulletin,

Abstract No.130. (Transl. from Koll. Zeits. 98, 1, 1942).

*Ockman D. Medicine in a Changing World (Heinemann 1941).

Powers P.O. Synthetic Resins and Synthetic Rubbers (a chart).
Chem. & Eng. News, Amer. Chem. Soc. XX 536 (1942).

RHEOLOGY ABSTRACTS.

Note: The Club assumes no responsibility for the opinions expressed by abstractors; these are given in square brackets.

105. Classification of the rheological properties of industrial materials in the light of power-law relations between stress strain and time. G.W.Scott Blair and J. G. Calhoun. J.Sci.Instr., 19, p.88, 1942. A former empirical classification of rheological properties is discussed in the light of a power-law relation between stress, strain, time and partial differentiation of these with respect to stress and strain give expressions agreeing reasonably well with the earlier classification mentioned. Reasons are given for preferring the power-law treatment to the more usual division of strains into recoverable, and non-recoverable parts, both in respect of physical and subjective standards.
H.C.T.

106. Rotary viscometer for the determination of high consistencies. R.N.Traxler, J.W.Romberg and H.E.Schweyer. Ind. Eng. Chem., Anal. Ed., 14, p.340 1942. The design construction and operation of a new rotating cylinder viscometer is discussed. Its application to rheological studies is illustrated by results for asphalts over a range of 0.001 to 1000 megapoises. Novel features of the instrument comprise correction for both top and bottom end effects and a special design whereby the viscosity is measured at a constant mean rate of shear. The apparatus is particularly adaptable for measurements of equilibrium consistency, and studies of complex flow and the elastic properties of materials having relatively high viscosities.
B.R.R.A.

107. Viscometric estimation of particle dimensions. The system stearic acid - carbon tetrachloride. J.P.Hollander and D.R.Briggs. J.Phys. Chem., 46, p.685, 1942. Relative viscosities were determined with a probable error of three parts in 10,000 for 0.000-4.000 per cent stearic acid - carbon tetrachloride solutions. The determinations were made at a low rate of flow. As thus determined, the particle length - diameter ratio, as calculated by the Sakurafa procedure does not confirm that reported by Theis and Bull. A simple procedure for carrying out a rate of flow study is described.
B.R.R.A.

108. Influence of Shaking upon the thixotropic sol-gel transformation. W.Heller and H.L.Roeder. Trans. Farad. Soc., 38, p.191, 1942. The setting time of thixotropic systems changes measurably after shaking for a few minutes or for a few hours, depending on the stability of the systems. The setting time of thixolabile systems changes after shaking for a few seconds. The alteration of the thixotropic and thixolabile state by shaking is attributed to a mechanical coagulation. It is advisable to take such a shaking effect into account whenever setting times are determined as a relative measure of the thixotropic state. The formation of strongly anisometric aggregates by shaking does not lead to rheopexy but to the opposite effect.
B.R.R.A.

109. Calculation of viscosity from Stormer viscometer data. J.A.Geddes and D.H.Dawson. Ind. Eng. Chem., 34, p.163, 1942. To explore the possibility of describing the consistency of paints in more fundamental units, use of the modified Stormer viscometer on truly viscous oils has been studied. It has been found possible to correlate the viscosity of these oils with Stormer data, provided a correction for kinetic energy/

energy losses is made. The fork-type paddle ordinarily used on the modified Stormer viscometer has been replaced with a newer "submerged" paddle, which allows more reproducible readings. The formula developed for calculation of viscosity of truly viscous liquids is limited with respect to several variables, including temperature and container size (pint cans preferred). It is suggested that maximum tolerances of $\pm 0.25^\circ\text{C}$ be imposed in all liquid and paint measurements. Although containers from half-pint size upwards may be used, measurements made in containers of different sizes cannot be intercompared without correction. Further application of the kinetic energy correction to measurements of yield value and mobility of paint systems with Stormer viscometer is under consideration.

B.R.R.A.

110. A type of plastic deformation new in metals. E. Orwan Nature, 149, p.643, 1942. Plastic deformation of single cadmium or zinc crystals is described. This occurred by "kinking" which is a process distinct from ordinary flexural gliding. The mechanism of "kinking" is explained.

B.R.R.A.

111. Specific viscosity of suspensions and solutions. E.W.J. Mardles. Trans. Farad. Soc., 38, p.47, 1942. The ratio η/η_0 where η is the viscosity of a suspension of a finely-divided solid or solution of a colloid or crystalloid in a liquid medium of viscosity η_0 at the temperature of the experiment, was found for a variety of suspensions and solutions to be a function of η_0 , being smaller for lower values of η_0 especially below about 2 centipoises. The methods of varying η_0 were (a) by using liquids in the same homologous series, (b) by using binary mixtures of liquids, and (c) by changing the temperature of the experiment. The viscosity effect observed appears to be explicable by assuming orientation of the dispersed particles during flow, less eddying of the medium occurring in the thinner liquids when the particles assume more quickly positions of streamline flow.

B.R.R.A.

112. Some observations on the mechanical testing and flow properties of industrial plastics. E.G. Couzens and W.G. Wearmouth. J.Soc. Chem. Ind., 61, p.69, 1942. Little has been published regarding the most suitable conditioning treatment to be given to the test samples employed in the mechanical testing of plastics, and in particular of thermoplastics. Similarly, for ordinary tensile tests there is little information about the effect of the rate of stretching on the usual physical constants, i.e. ultimate tensile strength, Young's modulus, and elongation. The work here described indicates the effect of various conditioning treatments, and a suitable treatment for standard work is suggested. Findley's work on the rate of stretching of cellulose acetate test pieces is discussed and it is shown that similar results are obtained with many other thermoplastics. The effect of creep on the test results is important and some experiments on thin strips of copolymer are described which show that below a critical stress the rate of creep is negligible. This critical value may have some practical significance, since it probably approximates to the safe load to which the plastic can be continuously subjected without the development of creep. The heating effect arising when certain rigid plastics are stressed to fracture point is also described. Moisture in thermoplastic powders has a profound effect on their flow properties and the need for a standard conditioning treatment is demonstrated and stressed. Similarly, the effect of particle size is noted, and also the effect

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of increased stress conditions. The various methods of determining flow properties are reviewed, and their defects are listed by means of examples. Finally, the Scott Blair - Coppen equation is mentioned and its application to certain thermoplastic moulding compositions is discussed, values for polystyrene and cellulose acetate compositions being given.

B.R.R.A.

113. Equation of motion for the steady mean flow of water in open channels. G.H. Keulegan. J. Res. Nat. Bur. Stds., 29, p. 97, 1942. There is disagreement in the literature regarding the use of the Coriolis and the Boussinesq velocity - distribution coefficients, in the open-channel flow equation. It is shown in this paper that the use of either coefficient is correct, provided the terms representing the effects of resistance are properly interpreted. The methods of deriving the two forms of the flow equation are given in detail, and it is shown that in the form of equation containing the Boussinesq coefficient, the friction coefficient is related directly to the wall coefficient. In the form of equation containing the Coriolis coefficient, the friction coefficient is related to the rate of energy loss in water. This has a direct bearing on the correct use of Manning's "n" in the equation of flow in open channels

B.R.R.A.

114. Subjective Conception of the firmness of soft materials. G.W. Scott Blair and F.M.V. Coppen. Amer. J. Psychol. 55, p. 215, 1942. The conception of "firmness" is discussed in relation to physical theory. Its analysis into components having simple dimensions is apt to destroy much of the original concept and although dimensional simplicity is essential for physical measurements some extension of the theory of dimensions seems advisable in view of the psychological facts. Experiments are described in which individuals (subjects) compared, for firmness, true solids with true fluids. Pressure of handling was found to have no effect, but the time allowed for compression (t_c) was found to influence their judgements in such a way that the curve plotting percentage "fluid softer" judgments (p) against $\log (nt_c)$ was unique and linear over its central portion. From this curve it could be calculated that t_c must be one-third of the physical unit of time to obtain agreement between subjects' judgments and physical measurements. This means that fluid materials are judged as relatively "soft". A subsidiary experiment showed that in these comparisons the average subject fully compensates for the permanent flow of the fluid.

The psychological implications are discussed and a slight modification of the Nutting power-law equation is proposed for use in comparing subjective and objective data.

Authors.

115. Differential threshold for the subjective judgement of the elastic and plastic properties of soft bodies. F.M.V. Coppen. Brit. J. Psychol. (Gen.) 32, p. 231, 1942. Methods are described for measuring the differential threshold for "firmness" of mixed materials i.e. the accuracy with which comparisons for firmness can be made by individual people (subjects). One method involves the use of a known pressure and a preliminary experiment is described in which ability to reproduce a pressure chosen by the experimenter was measured and compared with reproducibility when the pressure was chosen by the subject. Results were fairly successful but further investigation is required. The data for a threshold

/curve

curve were estimated from data obtained in a previous experiment and the curve so derived was found to be barely distinguishable from that for a true fluid. Previous experiments had shown that true solids could be judged with three times this accuracy.

It was found that a skilled cheese-maker gave a superior performance when judging her own material. The superiority of routine analysts was confirmed. The meaning and nature of the subjective concept "firmness" are discussed.

Author.

116. Variations in certain properties of bovine cervical mucous during the oestrus cycle. Biochem J. 35, p.1039, 1941.

The Oestroscope: An instrument for detecting oestrus in cows. Vet. Record Nov. 29th, 1941.

G.W. Scott Blair, S.J. Folley, F.H. Malpress and F.M.V. Coppen. Viscosities and nitrogen contents of cervical mucous are minimum at oestrus but viscosity measures are liable to error due to contamination of samples and N-analyses are unsuitable for field tests. Flow-elasticities are less affected by contamination and can be readily measured in a simple capillary apparatus. A marked peak in flow elasticity at oestrus is readily observed even when behavioural symptoms in the cow are not apparent. The test should save the farmer much time in getting the cows into calf.

Authors.

117. Simplified modification of the Scott Blair-Coppen test for the pitching consistency of cheese curd. G.W. Scott Blair and M.F. Scott Blair. J. Dairy Res., 12, p.322, 1942. The test described in earlier papers (abstr. nos. 17, 66) required rather too accurate timing for factory use. Authors show that test can be done at half the original speed and that since quite big error in timing has little effect on results, the times can be judged adequately without using a stopwatch. This simplifies the test considerably.

Authors.

118. Rheology of butter. (1) Methods of measuring the hardness of butter. (2) Relation between rate of shear and shearing stress. The effect of temperature and of re-working on hardness and on structural viscosity.

(3) Effect of variation in butter making conditions on the hardness of the butter. R.M. Dolby. J. Dairy Res. 12 pp.329, 337, 344, 1942.

(1) A comparison between data from compression of cylinders of butter and sectility (force required to cut blocks with a wire). The load (sectility) required to give constant rate of cutting is proportional to diameter of wire and to its length. Good scatter curves relate sectility to compression viscosities.

(2) A summary of different types of flow-curve. With wire cutting, rate of shear is related by a power law to load. The stress-exponent tends to decrease as temperature is raised. Working reduces hardness (sectility) but this increases on resting.

(3) Effect of conditions of manufacture on rheology of butter. Principal factor is rate of cooling. Rapidly cooled cream gives a harder butter.

Agreement between sectility and compression viscosities is remarkable since the wire is cutting continuously fresh material and effects of work-hardening and thixotropy are eliminated or nearly so. In compression of cylinders these effects are very marked. Perhaps there was a chance cancellation.

G.W.S.B.

119. Rheological properties of secretions of the cervix of pregnant and non-pregnant cows. G.W. Scott Blair, A.T. Cowie and F.M.V. Coppen

F.M.V. Coppen. *Nature*, 149, p.609, 1942. Characteristic differences in the flow-curves of bovine cervical secretions using an emptying tube viscometer, suggest a possible

G.W.S.B.

120. Relaxation effects in amorphous media. R. Simha. *J. App. Phys.*, 13, p.201, 1942. The Maxwell relaxation theory leading to the concept of a viscous-elastic body is briefly noted. The theory is extended to systems composed of several viscous-elastic components, with different relaxation times. A continuous distribution of relaxation rates is assumed. Equations are derived, whose solution gives the distribution of relaxation rates in terms of the rate of deformation and the applied stress, or the elongation in terms of the other two quantities. The connections with distribution of dielectric relaxation times, molecular inhomogeneity, and effects observed at mechanical frequencies large compared with the relaxation rates, are discussed. R.C.S.

121. Firmness in compression and tension. D.C. Broome and E. Bilmes. *Nature*, 149, p.413, 1942. A comparison is made of the values of K and $\log \gamma$ determined by compression, tension and torsion methods. The discrepancies are attributed to differences in the changing cross-section of the specimen under test. A correction is given for extension data, which does not entirely eliminate anomalies, and it is stated the intermolecular forces of repulsion and cohesion may be responsible. R.C.S.

122. Extension and rupture of cellulose acetate and celluloid. R.N. Haward. *Trans. Far. Soc.*, 38, p.394, 1942. The author gives an interesting account of a research into the characteristic properties of the tough plastics. The results of measurements made on the extension and rupture of cellulose acetate and celluloid, are accounted for, on the assumption that the two processes are largely independent. Nutting's equation $\sigma = \frac{1}{\psi} S^{\beta} e^{\frac{K}{\psi}}$ is modified to give an extension equation

$$\frac{1}{\Sigma} - \frac{1}{A} = \frac{\psi}{S^{\beta/K}} \left\{ \frac{1}{e(1+\Sigma)^{\beta/K}} \right\}$$

where Σ = the non-ideal part of the total strain. The significance of the equations derived, is discussed, and it is shown that high impact resistance is associated with materials which extend under high or moderate stress with a large crude stress index (β/K) , and are capable of quick rupture, only at stress markedly higher than those at which the rates of extension are readily measurable.

R.C.S.

123. Highly elastic deformation in polymers. A.P. Alexandrov and J.S. Lazurkin. *Acta Physicochemica URSS.*, 12, p.647, 1940. A relaxation scheme is developed, by means of which the influence of temperature and duration of the applied stress on the deformation of highly elastic bodies can be described. The results for a number of substances show a qualitative agreement with the suggested scheme and an insight is given into the physical nature of the deformation process. The relationships for the processes of electrical and mechanical relaxation are shown to be similar, indicating their physical nature to be the same. R.C.S.

124. A possible molecular interpretation of stickiness tackiness and spinnability. D. Jacobowitz H. Mark. *India Rubber World*, 1942, 106, A molecular picture is given for the intrinsic property described as stickiness, tackiness or spinnability, and the theory is applied to the case of rubberlike materials. e.g.

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natural rubber, butadiene rubbers. The systems which display this property are stated to be intermediate between elastic solids and viscous liquids and show two main characteristics: (a) they merge fairly rapidly at room or higher temperatures and at small pressures, and (b) they show resistance to forces of stress and shear, if an attempt is made to separate them after merging.

An explanation is given of the increase of tackiness etc., produced by temperature increase, degradation, solvents of plasticizers, and of the decrease in such properties produced by temperature decrease, cross-linking or gelation and crystallization. An excellent bibliography on the subject is given.
R.C.S.

125. High Speed rotational viscometer of wide range. H.Green. Ind. and Eng. Chem. (Anal. Ed.), 14, p.576, 1942. A concentric cylinder rotational viscometer is described suitable for measuring the viscosities of oils, varnishes, paints and printing inks. Results with it confirm the Reiner flow equation. Measurement of a standard oil gave results which agreed with the Bureau of Standards' value to within $\pm 1\%$ and measurements of "plastic viscosity" can normally be duplicated to within $\pm 5\%$. The use of the instrument with thixotropic systems is discussed.

[The paper contributes little that is new to the subject]
V.G.W.H.

126. Statistical thermodynamics of rubber. F.T.Wall. J. Chem. Phys., 10 pp.132 and 485, 1942. The kinetic theory of elasticity of long molecules is extended by an original mathematical method to the case of a 3-dimensional network of molecules corresponding to the supposed structure of vulcanised rubber. The conclusion is that Hooke's Law should be obeyed for a simple shear deformation, but not for an elongation. For the latter case the relation derived is identical with that of Guth and James (Abstr. No 74), and is of the form required by Mooney's general rheological treatment.

[The most important development in this field since Kuhn (1936)]
L.R.G.T.

127. Rheologic and elastometric measurements of rubber products. F.Höppler. Kautschuk, 17, p.17, 1941. (Translation in Rubber Chem. and Tech., 15, p.115, 1942. A "consistometer" is described in which a sphere, cylinder or conical element is forced through a larger cylinder containing the material investigated. Data on the flow curves, thixotropy, elastic recovery, plastic and other properties and their variation with temperature are given for various rubbers and rubber solutions. The results are given in c.g.s. units.

[From the author's description, this is surely the Universal Rheometer we all want! After discounting excessive claims there remains a useful body of data of much interest, intelligently presented.]
L.R.G.T.

128 Structure and reactions of rubber. Trans. Farad. Soc., 38 August 1942. Many of the papers touch on rheology. Of chief interest are the following:-
The plastic-elastic behaviour of ebonite. J.R.Scott.
Thermodynamic study of the elastic extension of rubber. L.R.G.Treloar.
The kinetics of rubberlike elasticity. D.D.Eley.
The kinetics of high elasticity in synthetic polymers. R.F.Tuckett.

L.R.G.T.

129. Town gas and kinematic viscosity. A.Coe.
 Gas Journal, 237, pp.390, 393, 435, 437, 238, pp. 62,
 64, 67 and 102, 1942. Relation between combustion charac-
 teristics of a combustible mixture of gases and kinematic
 viscosity are discussed at great length, concluding that
 the problem is that of flow. Consequently correct kine-
 matic viscosity is the main characteristic of the gas.

L.A.S.

130. History of viscometry. F.Höppler. Koll. Zeits.,
 98, p.1, 1942. In 1885 there was found, in W.Thebes the
 ruined tomb of Amenemhet, a Keeper of the Royal Seal,
 16th century B.C. When the inscriptions were finally
 translated they were found to include a description of a
 water clock for use at night. This consists of a truncated
 cone-shaped vessel with a hole at the bottom out of which
 water ran. The interesting point is that the angle of the
 cone is some degrees different from the correct calculated
 value, a fact which the physicists of the time must surely
 have realised. Amenemhet however, describes the clock as
 working correctly.

Höppler has made a similar clock, and by imitating the
 temperature fluctuations of the Egyptian night (assumed
 to be unchanged in the intervening centuries) has shown
 that the temperature effects on the viscosity of water can
 account for the empirical correction which Amenemhet was evidently
 obliged to make.

Five thousand years ago, the Sumerians used the outflow
 of water from a vessel to define units of time and weight
 but the temperature effects are not known to have been
 appreciated. The author goes on to outline the history
 of water clocks from these remote times up to the much
 later use of a similar apparatus in the form of the modern
 orifice viscometer.

This is an interesting account of what is probably the
 earliest account of work on applied rheology.

Copies of translation of this paper are available for
 loan to members on application to the Secretary.

G.W.S.B.

131. Frictional phenomena. A.Gemant, J.Appl. Phys.,
 12, 1941: I, p. 530: II, p.626: III, p.718: IV, p.725:
 V, p.827: 13, VI, p.22: VII, p.90, VIII, p.210:
 IX, p.290: X, p.355.

A general discussion on all kinds of friction. "All
 frictional phenomena are of the dissipative type. In mechanics
 dissipative processes are treated in contradistinction to
 conservative ones, in which latter there is an interconversion
 of work and kinetic or potential energy". In shearing a
 material, work is used up in three different ways (1) trans-
 formation into kinetic energy (2) stored as elastic energy
 (3) lost as heat. The author develops general equations for
 all three of these and finally considers application to flow
 between parallel plates.

II. Friction in gases.

III. Absorption of sound waves and supersonics.

IV. Sound absorbing materials. Principles of room-acoustics.

V. Liquids. An excellent summary of liquid structure theories.

Temperature and pressure coefficients. Deals specifically
 with mesomorphic materials.

VI. Measurements of viscosity in liquids. Propagation of
 sound and supersonic waves in liquids.

VII. Viscosities of colloidal solutions. Synthetic polymers.
 Effect of suspended particles in relation to viscosity of
 suspensions. Elongated particles. Summary of work of Staudinger
 and of Burgers.

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VIII. Structural viscosity. "Stationary flow" Relaxation processes. Maxwellian relaxation models. Vibrational processes.
 IX. Application of theory of liquid structure and viscosity to (electrical) insulating liquids, particularly for high voltage cables.
 X. Lubrication. Film and boundary lubrication.

[Professor Gemant's series of papers forms a kind of text book which is appearing by instalments in the J. Appl. Phys. and certainly constitutes a most valuable contribution to the subject. It is to be hoped that the papers will eventually appear in book form.]

G.W.S.B.

132. An extension of Saint-Venant principle, with applications. J.N. Goodier. J. Appl. Phys., 13, p.167, 1942. An application of the Saint-Venant principle to the case of thin layers of elastic materials confined between rigid plates and under all types of load.

G.W.S.B.

133. On the resistance to the uniform motion of a solid through a viscous liquid. R.B. Block. J. Appl. Phys., 13, p.56, 1942. In an earlier paper (ibid. 11 p.635, 1940) the author has studied the liquid slip at the surface of solids moving through liquids with special reference to the standardisation of the rolling ball viscometer. The present paper is an amplification answering criticisms by J. L. Burwell (ibid 12. p.257, 1941).

G.W.S.B.

134. Rubber in vibration. S.D. Gehman. J. Appl. Phys., 13, p.402, 1942. Vibration tests on rubber. The dynamic modulus is higher than the static. Studies of rubber in compression when ends of test-piece are held rigid and free to move. Effects of temperature. [Includes a good bibliography.]

G.W.S.B.

135. Relation between viscosity of solutions and physical properties of high polymers. R. Simha. J. Appl. Phys., 13, p.147, 1942. A good summary of work to date on physical properties of high polymers and the viscosities of their solutions, as well as relationships between molecular weights, structure of molecules etc.

G.W.S.B.

136. Theoretical approach to the problem of yarn strength. R.R. Sullivan. J. Appl. Phys., 13, p.157, 1942.

G.W.S.B.

137. Studies in lubrication X. F. Morgan, M. Muskat and D.W. Reed. J. Appl. Phys. 12, p.743, 1941. Friction phenomena and the stick-slip process (abstr. no. 40).

G.W.S.B.

138. Elastic after-effects and dielectric absorption in glass. N.W. Taylor. J. Appl. Phys. 12, p.753, 1941. Relaxation phenomena, elastic after-effect etc in glass. Follows Kuhn's treatment in considering material as built up of a series of elements, each with its own relaxation time each element relaxing in the simple exponential way.

G.W.S.B.

139. Structure and dynamics of liquids. W.E. Roseveare, R.E. Powell and L. Fyring. J. Appl. Phys. 12, p.669, 1941. "By coordinating our information on viscosity, diffusion melting, /and

and other rate(s) and thermodynamic properties, we arrive at a detailed picture of liquid structure. Thus we find that a liquid is best thought of as a solid to which a large number of empty equilibrium positions are added. In fact the expansion on melting, as well as the expansion with a rise in temperature, arises almost entirely from this introduction of new equilibrium positions and only to a minor extent from lattice expansion. We shall obtain information as to the number, size and energy of formation of these empty lattice points".
(Author's summary.) G.W.S.B.

140. Correlation between elastic moduli and viscosity of liquids and plastics. A. Gemant. J. Appl. Phys., 12, p. 680, 1941. The author proposes a general equation, tested for hydrocarbons, petroleum oils, plastics and glasses, from which the compressibility (K) (reciprocal of bulk modulus) can be calculated from the kinematic viscosity (ν) or vice versa. The equation is written $A/K = \rho (\log_{10} \nu + B)$ where $A = 0.43 \text{ MI/mnRT}$; $B = -\log_{10} \mu_0$; μ_0 = internal energy of lg. of material, ν is a number, M is molecular weight ρ is density. Repulsive and attractive forces are inverse powers, $3m$ and $3n$ respectively, of molecular distance. For practical purposes, B may be regarded either as a constant or as proportional to ρ , hence
 $A/K = \rho (\log_{10} \nu + C\rho)$.

This is clearly of very great significance if the author's treatment can be substantiated by further experiment.

G.W.S.B.