

described by R. G. Coleman. He showed that mineral deficiency was frequently associated with disruption of enzyme activity; amino-acids may accumulate, and symptoms of deficiency result. Discussion emphasized the complexity of mineral imbalance which could affect the level of other nitrogen compounds, for example, purines and pyrimidines, as well as amino-acids. The comparative insensitivity of ruminant animals to changes in the proportions of nitrogen compounds in their diet was attributed to the profound modifications brought about by microbial metabolism in the rumen.

Session 5 (nitrogen for crops) contained five papers. I. F. Phipps described the manufacture and use of nitrogenous fertilizers, dealing chiefly with Australia, where about 125,000 tons were used annually, mostly in the form of ammonium sulphate, although the popularity of urea was increasing. The papers on nitrogen fertilizing of crops were by L. G. Vallance (sugar), F. Chippendale (tobacco and horticultural crops), W. J. Cartmill (cotton) and S. A. Waring (grain and forage crops). One hundredweight of ammonium sulphate increased the yield of sugar by 25 hundredweight in Australia: the highest commercial application was 5 hundredweight ammonium sulphate per acre. There was considerable disagreement about the effects of different sources of nitrogen on tobacco quality, although the nitrate form was favoured in Queensland. With cotton in Queensland, responses to nitrogen were related to moisture availability; best results had been achieved where nitrogen fertilizer and irrigation were combined. Among possible adverse effects from nitrogen fertilization of grain crops were lodging, excessive nitrogen content in malting barley, and actual yield depression with droughted sorghum. Delegates spoke of the different soil depths exploited by different forage crops, the superiority of slow-acting nitrogenous fertilizers for some crops, and the growing popularity of urea as a source of nitrogen.

Session 6 (nitrogen for pastures) comprised two papers on sources of nitrogen, both including consideration of the influence of the grazing animal. W. W. Bryan considered the three symbioses legume/rhizobium, legume/grass and pasture/herbivore. World information on these relationships was almost wholly confined to temperate conditions; because of the many important differences of the tropical environment, a thorough study of these symbioses in the tropics was needed. Discussion revealed conflicting points of view on the importance and duration of the effects of nitrogen voided by the grazing animal. The need for perennial legumes capable of exploiting an improved soil environment, further information on native tropical pasture legumes as nitrogen donors and fundamental data on the mechanism of legume adaptation to difficult environments was emphasized. In reviewing the use of nitrogen fertilizer on pastures, E. F. Henzell pointed out that the widespread nature of nitrogen deficiency in tropical regions was accentuated by the lack of pasture legumes. There was a number of grass species with a growth potential appreciably greater than temperate grasses when nutrition was adequate. Because of the relatively low returns from pastoral farming and the high cost of nitrogenous fertilizers, insignificant quantities were now used on tropical pastures.

Discussion at the symposium inevitably dwelt on the fact that data applicable to the tropical environment were sadly lacking in such diverse fields as pasture utilization, nitrogen fixation by free-living organisms, soil nitrogen availability and the nitrogen metabolism and requirements of tropical pasture and crop plants. Those participating, most of whom were actively engaged in research on these and related fields, expressed the hope that the symposium would help to focus attention on the important problems of nitrogen in tropical agriculture.

A. G. EYLES

RHEOLOGY IN AUSTRALIA

A SYMPOSIUM on "Visco-Elastic Systems" was held during February 16-18 at the Division of Forest Products, Commonwealth Scientific and Industrial Research Organization, Melbourne. Organized by the host laboratory, the meeting was attended by more than fifty delegates from universities, industrial concerns and research institutes, and it foreshadowed some of the activities of the nascent Australian branch of the British Society of Rheology.

Opening the conference, Dr. F. W. G. White, chairman of the Organization, stressed the need to place industrial activity on the most mature and fundamental scientific basis. He welcomed the move to form a rheological society in Australia, which would provide more opportunity for co-operation on common problems in different scientific fields.

The topics were grouped into six sections. In the first of these, "Structural Interpretation", B. J. Rigby reviewed theories of rate processes, and illustrated the use of the Burte-Halsey theory by its application to the rheological behaviour of wool. R. S. T. Kingston applied rate-process theory to the analysis of time-dependent mechanical behaviour of wood at high stresses. A qualitative change in the flow process was indicated by a stress

region where energy constants underwent sudden changes.

H. G. Higgins presented a theoretical account of the behaviour of hydrogen-bonded materials, based on the work of Prof. A. H. Nissan. Chemical substitution of hydroxyl groups in cellulose can confirm the basic assumption that the mechanical response is controlled by the number of hydrogen bonds per unit volume. Dr. N. W. Tschoegl gave an account of his studies on monomolecular cereal protein films. The influence of the substrate on the visco-elastic properties of the film yields much information on the nature of bonding in the film. A. W. McKenzie discussed the influence of inter-fibre bonding in a paper on the tensile stress-strain behaviour. A qualitative change in the orientation of fractures with increased bonding is interpreted as an increase in shear strength relative to tensile strength. R. C. Gifkins, after briefly surveying the subject of deformations in crystals, suggested that apparent viscous relaxation in grain boundaries may be an interaction of dislocations and vacancies, that is, a discontinuous crystalline process.

In the second section, "Heterogeneous Systems", Dr. F. A. Blakey discussed the relative contribution of the cement paste and of the aggregate to the creep

of concrete. J. De Yong, in a paper with H. G. Higgins, described draining studies on a pad of cellulose fibres, representing an early stage of paper formation. Compressibility of the porous medium complicates both the Kozeny and the drag equations. L. Dintenfass presented a rheological classification of suspensions, separating the properties of the solid and the liquid phases. He correlated colloidal structural properties such as sedimentation volume with the flow-curves of paints and other systems.

In the following section, "Hygroplasticity", several papers were devoted to wood and one to wool. Dr. G. N. Christensen described the effect of rheological properties on sorption. He had observed that the rate of water sorption by thin layers of wood is inconsistent with diffusion control, and suggested it might be dependent on the relaxation of swelling stresses. Two important practical effects arising on drying wood, namely, 'collapse' and 'set', formed the subject of a paper by Dr. W. G. Kauman, who correlated macroscopic observations with the molecular processes in the cell wall. M. Feughelman discussed the effect of humidity on stress relaxation in wool, and suggested a model in which hydrogen bonds break in the presence of 'mobile' water. L. D. Armstrong presented experimental evidence on the great increase in creep of wood when changes in moisture content take place while the material is loaded. The influence of changes in moisture content was also observed by J. W. Gottstein, who used strips of wood veneer held at constant deformation and subjected to humidity cycles.

The fourth section was concerned with "Specific Materials". Dr. F. A. Blakey reviewed factors influencing the creep of gypsum plaster, and again emphasized the effect of free moisture content on the stress-strain-time relations. Various practical requirements of glazing compounds were discussed by E. R. Ballantyne, who compared the properties of oil-based and rubber-based compounds. C. Massey described tests on several thermoplastics with reference to their suitability for model structural analysis.

In a section on "Instruments", Dr. B. I. Aldrich, in a joint paper with E. L. Newman, described a Couette viscometer designed for testing syrup during fractionation; it accommodates a wide range of shear stresses and has close temperature control. K. G. Martin described a micro-viscometer and discussed factors in its operation.

"Continuum Theory" was the subject of the last section. Dr. P. U. A. Grossman discussed Prof. K. Weissenberg's ideas leading from an assumed restriction on stress directions for a given strain history to observable phenomena, such as cross-stresses.

A policy session was held, at which the possibility of future co-operation in the field of rheology was discussed. In New South Wales the branch of the Society of Rheology has already held several meetings and has arranged a full programme of activities for the current year, including lecture courses on rheology. Plans were discussed for broadening the interest in this field, and for holding future meetings both at the local and national level. P. U. A. GROSSMAN

GAS CHROMATOGRAPHY

THE Gas Chromatography Discussion Group of the Institute of Petroleum Hydrocarbon Research Group held its annual general meeting in conjunction with an informal symposium at the Brunel College of Technology, Acton, London, W.3, on April 22. The secretary, Mr. D. H. Desty, reported that the Group had had another successful year in which it consolidated its position following the rapid expansion of the past few years. Interest in the Group's activities has been well maintained and its status in the field is now well recognized on an international basis.

The abstracting service organized by the Group has made rapid progress, and more than 100 British and foreign journals are abstracted regularly by a team of 25 abstractors. The inaugural volume of "Gas Chromatography Abstracts", 1958, was published by Butterworths, London, on May 5, and has largely been the work of Mr. C. E. H. Knapman, the editor of the Group's editorial committee. This volume provides abstracts and, more particularly, a detailed subject index for 1,468 papers in this field published up to January 1, 1959. Succeeding volumes will appear annually.

Dr. A. T. James and Dr. D. Ambrose have taken part in the preparation by an international committee of preliminary recommendations on the nomenclature and presentation of gas chromatographic data, which were presented to the Analytical Section of the International Union of Pure and Applied Chemistry in September, 1959. These have now been approved in the International Union for publication. The Group's financial position is very sound, and its

financial year has been adjusted to coincide with that of the Institute of Petroleum Hydrocarbon Research Group (that is, to the end of September). No change in the annual fee (1 guinea), which is now primarily intended to cover the cost of publications issued by the Group, is therefore necessary.

The informal symposium which followed the annual general meeting was organized and introduced by Dr. J. A. Skellon of Brunel College of Technology, who commented on the active research interests of the College in the field of gas chromatography. The first paper, and perhaps the highlight of the meeting, was that by Dr. J. H. Purnell on the modification of solid supports. Dr. Purnell described measurements, made in his laboratory, of the adsorptive properties of 'Celite' and brick dust which show that whereas 'Celite' has the lower adsorption, brick dust has the more reproducible properties. These experiments were made with the view of studying treatments of the support which might reduce adsorption and minimize tailing of peaks. One promising method of treatment is the use of hexamethyldisilazane, which reacts with hydroxyl groups. Its practical application is simple and the treated support is unwettable and has reduced adsorption. Although chromatograms obtained on the treated support are improved, a further improvement is obtained if 0.1 per cent polyethylene glycol is added to the column with the stationary phase. One disturbing fact is that treatment of the support in this way has a slight effect on values of the specific retention volume even when the columns contain as much as 20 per cent of stationary phase.