

by J. A. Morrison and R. Rudham (National Research Council), who gave details of their identification of the mechanism of the anion diffusion process in sodium and potassium chloride crystals. Slow neutron diffraction measurements were described by a group of workers from Chalk River: D. G. Henshaw and N. K. Pope gave complementary experimental and theoretical accounts of the determination of the radial distribution function in solid and liquid helium and neon and in liquid argon, while B. N. Brockhouse showed how the incoherent scattering could give information on molecular motions and may provide a means of resolving some of the indeterminacies involved in the direct measurement of diffusion.

A second group of contributions dealt with transitions other than melting. R. W. Smith (University of Toronto) described investigations on the grey tin/white tin transformation carried out in Birmingham with G. V. Raynor, in which previous uncertainties of observation have been positively correlated with impurity content. D. Gagan and J. S. Dugdale (National Research Council) gave a preliminary report of work in which electrical resistivity measurements appear to provide information on the martensitic transformation in lithium.

Z. S. Basinski (National Research Council) outlined a theory of work hardening of face-centred cubic metals in which the main obstacles were provided by the 'forest' of dislocations; the theory appeared to apply also to body-centred cubic metals, but in that case at low temperatures the mechanical properties were dominated by a large Peierls-Nabarro force. Work on the liquid state was represented by an account given by A. C. Hollis Hallett (University of Toronto) of recent experiments on the viscosity of liquid helium.

The single contribution dealing specifically with melting was by J. S. Dugdale, who discussed the Lindemann melting formula in relation to inert gas solids. R. J. Uffen (University of Western Ontario) once again made a convincing defence of large-scale approximation and extrapolation, this time discussing certain tectonic and volcanic phenomena in terms of the pressure dependence of melting of various types of magma.

In these days of high-speed conferences it is pleasurable to report on one at which the pace and length of discussion were such as to enable at least one non-expert to participate with profit. An informal report of the proceedings is in preparation.

J. W. LEECH

ELECTRONICALLY EXCITED SPECIES

A SYMPOSIUM on "The Structure and Reactivity of Electronically Excited Species" was held at Ottawa during September 5-6 under the auspices of the Physical Chemistry Division of the Chemical Institute of Canada.

In his introduction to the section on structure, G. Herzberg directed attention to the rapid increase, recently, in the number of polyatomic molecules, radicals and ions for which rotational and vibrational analyses of electronic systems had been carried out. This had demonstrated that, in many cases, the shapes in the excited states are different from those of the ground-states. For example, acetylene, hydrogen cyanide and carbon disulphide are linear in their ground-states but bent in their first electronically excited states. Throughout the meeting it was clear that the predictions made by A. D. Walsh in 1953 had been substantiated most impressively. References were repeatedly made to Walsh's energy diagrams.

G. W. Robinson and V. E. DiGiorgio showed in a submitted paper that formaldehyde is non-planar in a low-lying excited state, while K. Allison and A. D. Walsh concluded that the same may be true for one or two of the excited states involved in the Rydberg transitions. G. W. King presented evidence for the conclusion that there is only a small change in molecular geometry on exciting the glyoxal molecule in the transition studied by him.

During this part of the meeting much interest was shown in the interactions between electronic and vibrational motions of polyatomic molecules. M. H. L. Pryce, U. Opik, H. C. Longuet-Higgins and R. A. Sack dealt theoretically with the dynamical Jahn-Teller effect, considering the energy-levels of a non-linear molecule in a doubly degenerate electronic state which is split by a doubly degenerate vibrational mode. K. Dressler and D. A. Ramsay dealt with the Renner effect in linear molecules. The lowest state

of linear NH_2 would be a Π state. Experimental results suggest that the ground-state is bent and the first excited state is linear, the vibrational levels of the hypothetical linear state correlating with the levels of those two states, half with those of the excited and half with those of the ground-state. The ground- and excited states are degenerate when the radical is linear but different in energy when it is bent. The radical HCO appears to behave similarly.

Two papers by J. N. Murrell and by D. S. McClure were submitted which discussed the transfer of electronic and vibrational energy between weakly coupled systems. This is a subject of very great interest at the moment.

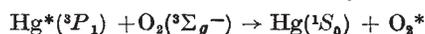
In addition to molecules and radicals the excited states of ions were discussed during the meeting. D. C. Frost and C. A. McDowell described their mass spectrometer which has been employed to determine the energies of the excited states of the ions produced in the instrument. This complements information that can be obtained spectroscopically, though so far detailed analyses of polyatomic ionic spectra are only available for CO_2^+ , CS_2^+ and C_4H_2^+ . Also J. W. Sidman, in an interesting paper, described results obtained for the nitrite ion in the crystalline state. From these he obtained information concerning the vibrational and lattice frequencies of the ground- and excited states.

There is doubt about the multiplicities of the excited states of some molecules and, in this connexion, A. E. Douglas presented some results for the Zeeman effect in the near ultra-violet bands of carbon disulphide. This indicates that the excited state is a triplet. G. W. Robinson and V. E. DiGiorgio concluded that the weak bands of formaldehyde studied by them were due to a singlet-triplet system.

On the theoretical side R. S. Mulliken suggested that it may soon be possible to make more reliable calculations of the energies of excited molecular states. He presented results for carbon monoxide, nitrogen and acetylene and for several molecules of the AB_2 type. The possibility of chlorine dioxide in the excited state being unsymmetrical was discussed, since the antisymmetric vibration appears to be excited on going to the upper state. J. W. Linnett discussed the electron distribution in the ground- and low-lying excited state of acetylene by transforming the molecular to equivalent orbitals. On this basis it was possible to understand why the carbon-carbon bond-length in the excited state is about the same as that in the ground-state of benzene and why the molecule is bent.

E. W. R. Steacie gave the introductory paper to the section on reactivity and pointed out that, while the evidence for excited species occurring in chemical processes had in the past often been very meagre, firmer knowledge of their participation in reactions is now being obtained. H. Eyring also gave a broad survey of the field and stressed the value of potential energy surfaces when considering chemical reactions theoretically.

There were several interesting theoretical contributions to this section. R. A. Marcus considered the case of electronically excited molecules reacting unimolecularly, the course of reaction being examined as motion on a potential energy surface. B. Stevens pointed out that while totally symmetric vibrations are excited when an electronic transition occurs, the excitation of non-totally symmetric vibrations are usually necessary for dissociation. A transfer of energy must therefore occur, and this will depend on the anharmonicity. Stevens suggested that the dissociation rate will consequently depend on the magnitude of optical energy taken up. E. K. Gill and K. J. Laidler discussed theoretically the reaction :



They reached the conclusion that both the theoretical and experimental evidence leads to the view that oxygen is produced in the $^3\Sigma_u^+$ state. This involves the minimum transfer of energy from one form to another. Potential energy surfaces were used by these authors also.

H. E. Gunning described experiments which made use of a mercury-vapour lamp charged with mercury-202. With this, mercury-202 could be excited in ordinary mercury vapour in the presence of gases with which the excited mercury could react. Isotopic enrichment in a solid product indicated that this

was formed in a primary process; no enrichment indicated that it was formed secondarily. No enrichment in mercuric oxide was obtained from nitrous oxide and oxygen but enrichment in mercurous chloride was found with hydrogen and methyl chlorides and with carbon tetrachloride.

J. D. McKinley and S. C. Polanyi had mixed atomic sodium with atomic and molecular hydrogen. They discussed the reactions that might lead to the chemiluminescence (sodium D lines) that is observed. J. C. Polanyi and also C. L. Arnot and C. A. McDowell discussed the results they had obtained for the rate of transfer of vibrational energy to translational when iodine is excited by the mercury green line to the twenty-sixth vibrational level of the excited state in the presence of inert gases. The competition between energy transfer and fluorescence is studied. Arnot and McDowell found that the ratio of rates was greater than expected from theory and suggested that the fluorescence lifetime may be less than has been supposed.

T. M. Sugden and E. M. Bulewicz and also F. Kaufman described work on the green emission that is obtained when nitric oxide is added to systems containing oxygen atoms. The former workers concluded that the intensity of the glow is determined by a more complicated process than the simple combination of atomic oxygen and nitric oxide.

G. J. Minkoff discussed the polymerization of acetylene and considered the possibility that a bent triplet diradical might be involved in the mechanism.

H. P. Broida and K. E. Shuler described the use of the reversal of iron lines in studying flame temperatures. This proves to be a sound method if equilibrium is established. Moreover, it is possible to discover when equilibrium is not established. P. Carrington had studied the emission by $^3\Sigma^+\text{OH}$ radicals in oxy-acetylene flames. It appears that the electronically excited radicals are deactivated at nearly every collision, so any departure from the equilibrium distribution that is observed must represent the situation prevailing on the production of the excited radicals.

J. Hecklen and W. A. Noyes described photochemical experiments that had been carried out with ketones and bi-acetyl. In the latter case they concluded that triplet excited molecules were involved. They discussed the decomposition, fluorescence and phosphorescence of these substances. H. Okabe described work on the fluorescence and photolysis of hexafluoroacetone. The effect of pressure and the addition of foreign gases was studied.

J. W. LINNETT

SUPPLY AND DEMAND

PROF. M. G. Say delivered his chairman's address before the Supply Section of the Institution of Electrical Engineers on October 23. The address, which was given under the title "Too Much and Too Little", was by no means confined to strictly technological considerations, and constituted, rather, a broad philosophical review of the persistent disparity between demand and supply, between needs and resources. Commenting on the use of the figure representing the power available per head of the population as an index of the standard of civilized life, Prof. Say remarked that in North America,

Western Europe, and the Soviet Union, energy resources were being developed as fast as practicable, while in the underdeveloped countries—representing three-quarters of the habitable world and two-thirds of the world's population—the demand for auxiliary energy was beginning. With the development of nuclear energy the production of electric power, which until now had been dependent upon coal, oil, or water-power, had become largely independent of geography or geology. It must, however, be remembered that a country might remain poor and underdeveloped because poverty put out of reach the