

made for an arduous but satisfying five days.

Sessions were held in the following areas: electron microscopy of long and short-range order, interstitial compounds, ordering in oxides, ordering and electronic structure, order in 1D and 2D systems, ionic superconductors, theoretical models for ordering and kinetics, spinodal decomposition and critical phenomena, martensitic transformations and pre-transformational phenomena.

There were five main highlights of the sessions:

(1) J. Van Landuyt showed a movie taken in the electron microscope of the phase transformation from  $\beta$  to  $\alpha$  phase in silica. The  $\alpha_1$  and  $\alpha_2$  phases are related by rotation of silica tetrahedra (Dauphiné twins) and  $\beta$  can be considered as involving the average of the positions in these two phases. As the transformation starts, or just above it, small regular arrays of domains of  $\alpha_1$  and  $\alpha_2$  appear, oscillate and grow.

(2) Extensive quantitative experimental tests of the theory of continuous transformations were presented by R. Schwahn and W. Schmatz (Jülich), J. De laFond, A. Junqua, J. Mimault and A. Naudon (Poitiers) with Al-Zn alloys, by M. Bronsveld, W. Alsem, E. W. van Royen, J. Vrijen and S. Radelaar (Groningen and Utrecht) with Cu-Ni alloys, and Chen and Cohen (Northwestern University) with ordering systems. The spinodal can be located from the changes in incubation time for small-angle scattering and the shape of the scattering. At long wavelengths, the linear near-neighbor form of the theory appears to be adequate, but at moderate and short wavelengths, terms involving more distant neighbors must be added. Absolute intensity measurements can provide data on the Helmholtz free energy and gradient energy.

(3) Theoretical calculations of the interaction of lattice defects appear to be well on the way to establishing the causes of the extended defects in oxides (C. Catlow, B. Fender and D. G. Maxworthy, Oxford and University College, London). Already good agreement with the large defect arrays observed in wüstite has been obtained.

(4) It appears (at least so far for thin films) that very large modifications of Young's modulus and diffusivity are possible by proper choice of the wave vector of a composition fluctuation (T. Tsakalakos, Rutgers University, and J. E. Hilliard, Northwestern University).

(5) Control of defects and defect arrays in the superionic conductor  $\beta$  alumina is approaching the level of control avail-

able in semiconductors. Preparation of the stoichiometric phase was reported and the conducting ions in the layers between the spinel blocks were shown to be locally clustered. Whether these clusters move during conduction must await dynamical studies (R. Comès and co-workers, Orsay).

Studies on ordering and clustering are well under way in many oxides and carbides but in many cases these are in the very early stages, with the structure of ordered phases being determined from spot positions without intensity measurements, and the local atomic arrangements being characterized from a simple analysis of the diffuse scattering. Much remains to be done in these areas. On the other hand, the role of electron-phonon interactions, and the condensation of soft modes to produce charge-density waves and periodic lattice distortions are well in hand. There is thus increased interest in what happens just above first-order transitions to learn about what causes the anharmonic coupling that seems to be controlling many such reactions. This will undoubtedly be a major topic at the next such conference three or four years hence.

The proceedings will be published in a special issue of *Journal de Physique*. As most manuscripts were delivered at the conference this issue should appear early in 1978.

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### **One Day Symposium on X-ray Diffraction and Spectrometry to Discuss the (UK) Draft Ionising-Radiation Regulations 1978, London, 12 July 1977**

The symposium, organized by the Crystallography and Spectroscopy Groups of the Institute of Physics, was very heavily over-subscribed and attendance was closed by the organizers at about 300. In spite of the large numbers the organizers succeeded in coping admirably, and a fruitful day's discussion resulted.

The morning session was opened by

Mr P. F. Beaver (Principal Inspector, Health and Safety Executive), who set out the historical background to the present situation. Following the publication of the 1974 Health and Safety at Work *etc.* Act, the Health and Safety Executive was charged with the task of drafting regulations. In effect, Section 1 of the Health and Safety at Work Act says that previous safety regulations should be progressively replaced by new regulations reflecting current thinking, and a system of Regulations and Codes of Practice designed to improve or at least maintain the previous standards of health and safety.

The procedure by which legislation will be enacted is as follows:

- (1) An informal dialogue with the users.
- (2) The production of a first draft which will, in practice, be written by legal experts.
- (3) Agreement of the draft by the Health and Safety Executive.
- (4) Agreement of the draft by the Health and Safety Commission.
- (5) Formal consultation on the basis of this draft with interested parties.
- (6) Agreement of the final form of the legislation by the Health and Safety Commission, the Secretary of State and Parliament.

We are approaching the end of Stage 1.

The relevant earlier regulations, Codes of Practice, *etc.* are enshrined in a number of documents which include the Factories Act 1961, the Ionising Radiations (Sealed Sources) Regulations 1969, the well-known *Notes for Guidance* and, of course, the Health and Safety at Work Act 1974. The new regulations must also embody the provisions of the Euratom Directive.

The dialogue with users has been undertaken by 17 Working Groups, of which the Principal Inspector was Chairman of the Steering Group (Group 1), and of the X-ray Diffraction and Spectrometry Group (Group 12). The draft for discussion produced by Working Group 12 was provided for each participant. Since the Bristol conference and during the life of these Working Groups the Health and Safety Executive's philosophy has changed quite markedly.

The draft was discussed in detail by the second speaker, Mr E. G. Weatherley (Health and Safety Executive). He emphasized the terms of reference under which the Health and Safety Executive were working: that the standards should not be lower or less comprehensive in any respect than those set by existing Codes; that the regulations must be homogeneous in application so that they apply equally to all places of work. He also made it clear that the Health and

Safety Executive are very well aware of the very wide range of interests and traditional methods of working, which in practice create great difficulties when one seeks to write new legislation for universal application.

One very important organisational change is contained in the draft proposal. It is clearly recognized that in the field of research there are occasions when it is extremely difficult, or even impossible, to satisfy the necessary provisions of the Act. In these situations it is proposed to establish a system whereby Radiation Protection Advisers will be able to issue authorization certificates which will specify how such work may be carried out.

A number of the talks were given by other members of Working Group 12, and each expressed their personal viewpoint. Dr G. S. Linsley (National Radiological Protection Board) summarized the statistics on accidents and explained the operation of the NRPB, which since 1960 has been providing advice and elaboration on the existing *Notes for Guidance*. The incident rate in the UK has been about one per 200 X-ray sets per year (incidents include possible overexposure, monitoring errors and injuries). The NRPB survey noted that, among 18 recorded incidents, 14 were the results of human errors, two resulted from mechanical failure and two were unspecified. Six of the incidents might have been prevented by better shutter design. Dr Linsley explained that in addition to the regulative documents, which contain terms such as 'effective arrangements', 'adequate and effective', and 'reasonably practicable', there will be further elaboration in appropriate *Notes for Guidance*.

Dr B. J. Isherwood (GEC, Hirst Research Centre) spoke from the user's viewpoint. He highlighted the problems of those workers who were not previously covered by the Factories Act. Whereas users covered by the Factories Act will probably not feel any great change in the measures required of them, other workers will for the first time be included. He pointed out that the record of accident statistics showed that in the fields of X-ray Diffraction and Spectrometry very high standards of success were already demonstrated. It could well be argued that the work entailed in producing the new legislation and in running the organisation which will be necessary to ensure compliance, is out of all proportion to the possible benefits since the total number of incidents is already very small. There has been a great debate about whether or not microswitches would be acceptable as a means of interlocking safety circuits.

Dr Isherwood pointed out very forcibly that the many new and ingenious safety devices which seemed to be favoured by some of the potential legislators were not known to be safe, and in cases where some knowledge exists might even be less reliable than microswitches. He also pointed out that following the Euratom Directive, other European nations are simultaneously producing legislation which may be materially different from the proposed UK regulations. This could cause difficulties when export sales were made and, at the very least, would have the effect of increasing costs.

Mrs E. Martin (University of Kent) is a practising Radiation Protection Officer. She gave an especially coherent and well developed talk on the implementation of the Regulations. She strongly endorsed the view expressed earlier that the task of drafting 'universal regulations' is obviously a difficult one. She drew attention to the fact that the Robens Report, which paved the way to the Health and Safety at Work Act 1974, had recommended that we should move away from legislation and rely more on Codes of Practice. It is therefore a little odd that we are stampeding in the other direction.

Mrs Martin pointed out that the most difficult area which the new legislation would encompass is that of research. Researchers are highly trained and very highly qualified independent thinkers who do not take kindly to this kind of legislation, particularly when the legislators themselves are less qualified than those who will have to live with the legislation. Radiation Protection Officers are rather worried that they might be submerged in administration, and be made to serve as a buffer between the users and the Health and Safety Executive. She also reiterated the remark made by an earlier speaker to the effect that one should make some attempt at cost benefit analysis. She emphasized the view that the safety record has been very good so far, and ventured to estimate that if the new Regulations eliminated accidents such as those which have already happened, then each finger saved might require at least £100 000 of investment. In the UK legal and financial context, that appeared to be a rather high price. Mrs Martin also drew attention to the fact that the person most at risk in all of this is without doubt the Maintenance Engineer. He is often working in conditions where interlocks are overridden, and in situations where the contractual constraints upon him can be quite complicated.

Mr P. Hurley (Pye Unicam, Cambridge) spoke about the difficulties encountered

by manufacturers. It is not helpful that different countries in the Common Market are proposing to draft individual legislation. The Euratom Directive is supposed to be implemented by June 1978, and yet this legislation is still a long way from its final form. There is not enough time for new equipment to be modified, and it is out of the question to think in terms of modifying old apparatus by this time next year. He pleaded strongly that the Health and Safety Executive should ensure that the education of their inspectors is properly organized, and emphasized that it is important that different inspectors, at different times, should give consistent replies to questions.

Mr Hurley enquired in detail about the status of apparatus which now satisfies the Factories Act, and it became clear that much of the apparatus would not pass the new Regulations. Definitions of some of the terms mentioned in earlier talks are urgently needed.

Mr H. Burgess (UKAEA, Systems Reliability Directorate) gave a short introductory talk on the estimation of probability of failure in engineering systems. He emphasized that failure-mode analysis was by now a well-established procedure, and that systems could be evaluated so as to produce figures of the probability of failure per year. He went on in detail to give figures of the failure rates of components and to demonstrate how these could be used to arrive at failure rates for systems, and indicated the bearing that this had in terms of fatal accident rates.

The afternoon session allowed delegates to question all of the speakers, and proceeded, *ad hoc*, under the Chairmanship of Dr P. G. Owston. Three topics seemed to be of most interest: the role and status of Radiation Protection Advisers, the question of system approval and the question of risk and cost-benefit analysis.

Users must be adequately instructed, but it appears that no system of instructor certification is envisaged. Radiation Protection Advisers will be locally recruited in the main. Whereas the Euratom Directive requires that training courses should be set up, the Health and Safety Executive appears to believe that there are enough appropriate courses already in existence in the UK. In practice the Radiation Protection Advisers will have to be 'approved' by the Health and Safety Executive for the job they are doing. The required standard may vary with the situation. Broadly speaking, we might expect to have between 300-500 Radiation Protection Advisers in the UK, of whom about 80 might be in hospitals and 100 in the nuclear

energy industries. The Radiation Protection Adviser would be responsible for specifying the conditions of operation where it is not reasonably practicable to meet the requirements of the legislation. Whereas students are not 'at work' under the terms of the Act, it is envisaged that they will be treated exactly as employed persons in this legislation.

From many points of view, some form of type approval or system approval would be very useful. There might, for example, be British Standards. In discussion it was made clear that the 1974 Health and Safety at Work *etc.* Act does not *require* that the Health and Safety Executive initiate schemes of approval. The new legislation is more stringent than the Factories Act in practice, since it will require that protective devices are not only supplied but are properly maintained and used. In practice, this could well be a very difficult legal area when manufacturers supply apparatus which is either subsequently modified or used in an unusual experiment.

A great deal of the discussion was centred on the question of the acceptable risk. In the spirit of the 1974 Act it is fairly clear that no risk at all is acceptable. Several delegates expressed the view that the risk is already so low that we should be very wary of the belief that legislation can improve the situation when there is no scope for much improvement. Statistics showed, for example, that about half of the accidents to date were due to human errors and carelessness, rather than poor design or the absence of safety measures. After much discussion it was agreed that open-beam diffractometers represented the greatest problem.

In a straw poll of the 300 delegates approximately 90% were found to be active X-ray users. None had ever had mild erythema. One had a finger burnt last year, and another burnt a finger 25 years ago. These figures are roughly consistent with the statistical details provided earlier by Dr Linsley and Mrs Martin in their talks.

In summary, the Crystallography and Spectroscopy Groups are to be congratulated for providing a timely, lively and informative discussion of this important programme of legislation. I am grateful to David Outteridge for comments on the manuscript.

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## Crystallographers

*This section is intended to be a series of short paragraphs dealing with the activities of crystallographers, such as their changes of position, promotions, assumption of significant new duties, honours, etc. Items for inclusion, subject to the approval of the Editorial Board, should be sent to the Executive Secretary of the International Union of Crystallography (J. N. King, International Union of Crystallography, 13 White Friars, Chester CH1 1NZ, England).*

Professor **A. J. C. Wilson**, Department of Physics, University of Birmingham, England, will resign as Editor of *Acta Crystallographica* and Chairman of the IUCr Commission on Journals on 31 December 1977 and will be succeeded by Dr **S. C. Abrahams**, Bell Laboratories, Murray Hill, New Jersey 07974, USA. Professor **J. Wyart** and Professor **H. Lipson** will also resign on 31 December 1977, as Co-editors of the journal. A more detailed report of these changes will be published in the January 1978 issue of Section A of *Acta Crystallographica*.

Dr **P. W. Anderson**, Bell Laboratories, Murray Hill, Sir **Nevill Mott**, Emeritus Professor at Cambridge University, and Professor **J. H. Van Vleck**, Emeritus Professor at Harvard University, have been awarded the 1977 Nobel Prize for Physics for their fundamental theoretical investigations of the electronic structure of magnetic and disordered systems. Their work has shown how a cheap and reliable material can be used to improve the performance of electronic circuits in computers, increase the capacity of the mass memories of such systems, and produce more efficient photovoltaic cells to convert solar energy into electricity.

Professor **B. G. Hyde**, formerly at the Department of Inorganic Chemistry of the Gorlaeus Laboratories, Leiden, The Netherlands, is now at the School of Chemistry at the University of Western Australia, Nedlands, Western Australia.

Dr **S. J. Joshua** is now at the Department of Physics at the University of the West Indies, Mona, Jamaica.

Dr **B. R. Pamplin** has been appointed Editor in Chief of the new journal *Progress in Crystal Growth and Characterisation* (Pergamon Press). Dr Pamplin is on one year's sabbatical leave from the University of Bath, England, at the Materials Research Center of Stanford University, California, USA.

Professor **Chatar Singh**, Foundation Professor of Physics in the University of Science of Malaysia and President of the Malaysian Institute of Physics, has been awarded the Order of Chivalry entitled

'Johan Setia Mahkota' by the Yang Dipertuan Agung of Malaysia. This is in recognition of his meritorious service to Malaysia in the field of higher education.

## International Union of Crystallography

### Prices of Acta Crystallographica and Journal of Applied Crystallography

The Executive Committee of the International Union of Crystallography has found it necessary to increase the yearly subscription rates and also the prices of back numbers for *Acta Crystallographica* and *Journal of Applied Crystallography* as from 1 January 1978. Every endeavour has been made to keep these increases to a minimum.

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