ABSTRACT

DEPARTMENT OF PHYSICS

5. Combination of X-Ray Focussing Mirrors in an X-Ray Microscope. Y. T. Thathachari and G. N. Ramachandran, *J. Indian Inst. Sci.*, Vol. 34, No. 67, 1952.

The paper contains a theoretical study of combination of spherical crystal reflectors which can give X-ray images similar to those in an optical microscope. The only possible combination is found to be that in which both the mirrors are concave and both have the same radius of curvature, so that the two mirrors form parts of the same spherical surface. Under these conditions, the Bragg relation is satisfied at both mirrors for any number of multiple reflections. By making use of N reflections, the optical path of the "microscope" for given magnification can be reduced to 1/N of that required with only one reflection.

6. Separation of Thorium from Monazite. S. R. Sivarajan, *J. Indian Inst. Sci.*, Vol. 34, No. 1, 1952.

A study has been made of the exact conditions of pH and concentration of solution, in the separation of thorium from sulphuric acid solutions of pure monazite, using ammonia as a precipitating agent. Initial studies of β-ray activity of the precipitates from solution were made and quantitative data were then obtained by chemical analysis, relating the percentage yield and purity of thoria to the pH of the solution.

7. The Scattering of Light by Colloidal Dye Solutions. S. R. Sivarajan, *J. Indian Inst. Sci.*, Vol. 34, No. 75, 1952.

An experimental study of the intensity and state of polarisation of the transversely scattered light in the case of some direct dye solutions of different dye and salt concentrations and at different temperatures, has been made. Therefrom certain general conclusions

regarding the shape, size and anisotropy of the dye micelles have been arrived at.

8. Thermal Scattering of Light in Cubic Crystals. V. Chandrasekharan, *J. Indian Inst. Sci.*, Vol. 34, No. 269, 1952.

The theory for the intensities of Doppler components in birefringent crystals developed in Part IV (Chandrasekharan, 1952) has been applied to the case of cubic crystals and general expressions for the intensities for 11 specific orientations of crystals belonging to T_h, O_h, and O classes and 6 crystal orientations of T and T_h crystal classes have been derived. The formulae have been used to calculate the intensities in the case of diamond and other cubic crystals and the results compared with the experimental data in the former case. There is not much agreement between theory and experiment.

9. X-Ray Studies on the Texture of Crystals. A New Method using Internal Reflections and its applications to Lithium Fluoride. V. M. Padmabhan, *J. Indian Inst. Sci.*, Vol. 35, No. 1, 1953.

The paper describes a new method of studying crystalline texture, employing internal reflections. It consists in obtaining internal reflection from a wedge-shaped crystal whose thickness varies from top to bottom and determining the variation of integrated reflection with thickness which was shown theoretically by Ramachandran to be different for perfect and mosaic crystals. Experiments were performed with ground, etched and chilled crystals of lithium fluoride and observations were found to be in accordance with the theoretical predictions. Crystals of lithium flouride, grown from melt, were thus found to be nearly perfect in structure.

10. Temperature Variation of the Refractive Index of Fused Quartz. P. S. Narayanan, *J. Indian Inst. Sci.*, Vol. 35, No. 9, 1953.

Using an interference method the temperature variation of the refractive index of fused quartz of optical quality has been studied from 30°C. to 750°C. The existence of an irregularity close to the

α-β transformation temperature of quartz has been confirmed and a secondary maximum close to the transformation temperature of cristobalite has been pointed out.

11. Thermal Expansion of Copper Sulphate. A. K. Sreedhar, *J. Indian Inst. Sci.*, Vol. 35, No. 17, 1953.

The expansion ellipsoid of a triclinic crystal, $CuSO_4 . 5H_2O$ has been determined. The necessary theory and the procedure to be followed in the case of triclinic crystals are given. The principal coefficients of expansion are:

$$41.68 \times 10^{-6},\ 29.27 \times 10^{-6} \text{ and } 4.45 \times 10^{-6}.$$

12. Self-Quenched Super-Regenerative Detector for Nuclear Magnetic Resonance. G. Suryan, *J. Indian Inst. Sci.*, Vol. 35, No. 25, 1953.

The self-quenched super-regenerator has been used to obtain nuclear magnetic resonance signals and has been found to be simple and sensitive. Experiments with the use of a r.f. coil capable of being rotated with respect to the magnetic field have indicated that the apparatus could be made to respond to induction or absorption. The sensitivity of the apparatus has been determined and is about ten times less than that possible with the bridge method.

13. Paramagnetic Resonance in some Cupric Salts. S. Ramaseshan and G. Suryan, *Proc. Ind. Acad. Sci.*, Vol. 36, No. 211, 1952.

By reason of their interesting magnetic properties, the cupric salts have been studied for their paramagnetic resonance spectra in some detail by many workers. In fact, of the ions of the iron group of elements Cu^{++}, with electronic configuration $3d^9$ occurs with spin $S=\frac{1}{2}$ only, when the orbital momentum is quenched and is therefore the simplest. The quenching of the orbital moment takes place in all the salts of copper as revealed by the extensive susceptibility data available. In order to explain the magnetic properties of the cupric salts, the predominance of exchange forces between the ions is invoked in addition to various types of internal electric

fields which contribute to the quenching of the orbital moment. The general character of the results show that these two effects predominate but a quantitative understanding of the many interesting features exhibited by the cupric salts await the collection of more data. The study of the paramagnetic resonance spectra of the salts of copper affords a better understanding of the nature of magnetic and electrical interactions in crystals. In the present work the study has been extended to eleven more cupric salts.

14. Structure of Halogenates of the Type A $(BO_3)_2$. H_2O. I. Barium Chlorate Monohydrate Ba $(C10_3)_2$, H_2O. Gopinath Kartha, *Proc. Ind. Acad. Sci.,* Vol. 36, No. 501, 1952.

The crystal structure of barium chlorate monohydrate has been completely determined. The crystals are monoclinic with space group 12/c-C^6_{2h} and four molecules in a unit cell with edges a=8.86A°, b=7.80 A°, c=9.35 A° and β=93° 26. The heavy atom positions were first fixed from Patterson projections and the atomic co-ordinate, of all atoms were obtained from Fourier projections along the three axes. In the structure, chlorate ions retain their usual low pyramidal form. Each chlorine is surrounded by four bariums and each barium by eight chlorines. Tables are given for the various atomic co-ordinates and the interatomic distances. The structure is able to explain qualitatively the known optical properties of the crystal.

15. The Transmission of X-Rays at settings near the Bragg Angle. G. N. Ramachandran, *Jour. Appld. Physics,* **23,** No. 500, 1952.

A theoretical investigation of the transmission of X-rays through calcite at settings near the Bragg angle has been made on the lines of Laue's theory for Bragg reflections. The asymetric transmission characteristics experimentally observed by Campbell have been fully accounted for and the importance of the effect of crystal thickness and absorption has been pointed out.

16. A means of stabilizing the Field of an Electro-Magnet. G. Suryan, *Jour. Sci. Inst.,* **29,** No. 335, 1952.

The use of a low capacity accumulator with a control coil in opposition to the mains voltage exciting an electro-magnet enables the attainment of very stable magnetic fields suitable for investigations in nuclear magnetic resonance.

17. Structure of Ba $(ClO_3)_2$. H_2O. Gopinath Kartha, *Acta. Cryst.*, **5**, No. 845, 1952.

The complete structure analysis of Ba $(ClO_3)_2$, H_2O has been studied. The structure amplitudes were obtained from Weissenberg photographs and the structure determination was based on two dimensional Patterson and Fourier projections along three axes. The relative accuracy in fixing the different atomic co-ordinates has been discussed. The proposed structure is in conformity with the strong positive birefringence of the crystal.