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Physics of IV–VI compounds and alloys. Edited by SOHRAB RABII. Pp. viii+253, Figs. 213, Tables 43. London: Gordon & Breach, 1975. Price £10.00.

The standard of most of the papers published in this volume is high and the proceedings of the Conference on the Physics of IV–VI compounds and alloys was an important survey of the subject in 1972. Particularly interesting is the section on *Transport Properties and Applications*, although unfortunately – such is the pace of current device technology – this is at the same time the most out of date. A large number of the predictions have more recently been achieved: for example, liquid-phase epitaxy techniques have been used to construct double-heterostructure lead tin telluride diode lasers; c.w. operation has been achieved at liquid-nitrogen temperatures in lead-salt alloy diode lasers.

Whilst it is useful to publish these papers – first published in 1973 in four volumes of the *Journal of Nonmetals* – under one cover, editorial improvements would have benefited it considerably. At the very least an index is helpful, and we would like to know which are the general surveys and which the contributed papers. In 1975 we could do with some more recent work and further references. The Conference Summary at the end is really just a list of what is in it, and is not a substitute for some up-to-date connective material about the nature of the subject and where it is headed.

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Magnetoelectric interaction phenomena in crystals. Edited by A. J. FREEMAN and H. SCHMID. Pp. viii+228, Figs. 104, Tables 29. London: Gordon & Breach, 1975. Price £10.90.

It is entirely possible that, even in the days before the advent of the modular physics 'course' (in which that revered discipline was reduced to a partial sub-set of weakly interacting components), the term 'magnetoelectric' did not figure very widely. In the attempt to produce conceptual simplifications, we related – obviously and logically – dielectric polarization to applied electric field, and magnetic polarization to applied magnetic field. Of course we were made aware – somewhat obliquely – that, through the laws of electromagnetism, electric and magnetic effects on real materials must be interrelated. Thus we should not have expressed surprise on being told that the polarization of a dielectric depends not only on an applied electric, but also on an applied *magnetic* field: and that the magnetic behaviour of a material depends on an applied *electric* field. Indeed the fairly natural assumption that the symmetry exhibited by any physical properties of a crystal corresponds to the symmetry of the Hamiltonian virtually precluded the possibility of the discovery, other than by accident, of magnetoelectric effects. The realization that the symmetry of a magnetically ordered crystal is actually *lower* than that of its Hamiltonian led to the prediction (as recently as 1960) by Landau and Lifshitz and by Dzyaloshinskii and to the experimental verification by Astrov and by Folen, Rado and Stalder of the first manifestation of magnetoelectric effects, in Cr_2O_3. Expressing the enthalpy of a crystal in terms of applied electric and magnetic field components, first-order magnetoelectric effects arise from the presence of terms of the form $\alpha_{ik}E_iH_k$ and second-order effects from those of the form $\frac{1}{2}\alpha_{ijk}H_iE_jE_k$ and $\frac{1}{2}\beta_{ijk}E_iH_jH_k$, although second-order effects have yet to be detected experimentally. For $Ga_{0\cdot92}Fe_{1\cdot08}O_3$, magnetic fields of the order 50–100 kilo-oersteds produce voltages of the order 0·5 V, depending on crystal direction. In piezoelectric paramagnetic crystals such as $NiSO_4.6H_2O$, the effect is smaller ($\sim$0·1 mV per kilogauss) and is referred to as the paramagnetoelectric effect. Further curious magnetoelectric effects are displayed by certain ferrites which at first sight appear to exhibit enormous electrostrictive effects, 11 orders of magnitude larger than those of barium titanate. These materials, of which Mn–Zn ferrite is an example, are however conducting and the observed effect is due partly to the magnetic field produced in the crystal by the conduction current. The term 'electromagnetostrictive effect' is more appropriate.

Topics such as those above are dealt with in this book, which contains the invited lectures, seminar papers and discussion contributions of the Symposium on Magnetoelectric Interaction Phenomena in Crystals, held in Seattle in 1973. Sections are devoted to (i) *Microscopic Mechanisms and Theories*, (ii) *Symmetry and Phenomenological Theory*, (iii) *Materials and Measurement*, and (iv) *Applications*. The papers reveal extensive effort in this new field and suggest that studies of these effects may provide new ways of obtaining information on magnetic symmetry, on antiferromagnetic phase transitions and a variety of other magnetic phenomena. Although applications of the magnetoelectric effect have yet to appear in the commercial device market (since most present needs which can be met by these materials are better dealt with in other ways) there are some areas which merit further exploration. In the field of optoelectronics, considerable use is already made of electro-optic effects; magnetic field switching or modulation of the electro-optic behaviour of a crystal may prove of some interest. Conversely, the electric field modulation of Faraday rotators could provide a tool for the future optical communications engineer. Possibilities exist of generating and amplifying spin waves and for providing phase shifters and polarization rotators in the microwave region. Although the material in this book is two years old, it still gives a very useful view of this intriguing new field, and contains review material which provides an excellent introduction to the subject.

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