07.9–8 PHOTO-ELASTIC AND ELECTRO-OPTIC EFFECTS IN CRYSTALS AND THEIR TECHNOLOGICAL APPLICATIONS: (A BRIEF REVIEW). By T.S. Narasimhamurty, Osmania University, Hyderabad-500 007, India.

A study of photo-elastic (acousto-optic) and electro-optic properties of crystals is very important due to their multifarious uses in several varied applications in science and technology such as electro-optical and photo-elastic modulators in laser techniques and television cameras, light communications, tunable narrow band optical interference polarization filters, etc. Hence a systematic study has been warranted on a variety of crystals of widely differing optical and other physical properties in order to discover new crystals having a better figure of merit, besides having other optimum physical properties to serve as acousto-optic and electro optic modulators and deflectors.

(a) When a transparent isotropic solid is subjected to a mechanical stress it develops artificial double refraction. When the solid is placed between crossed nicols and repeatedly "hammered" using a piezo-electric transducer it serves as an acousto-optic shutter/modulator. (b) When a light beam is transmitted through a solid excited by ultrasonic waves, it acts as a phase grating. For a certain angle of inclination of light beam with respect to the direction of propagation of the ultrasonic beam, the entire light energy is diffracted (called asymmetric diffraction or Bragg diffraction as distinguished from Raman-Nath diffraction) in the first order alone; the angle of deflection depends upon the frequency of the transducer, thus serving as an acousto-optic deflector. (c) Devices based on the Pockels linear electro-optic effect (i.e., development of artificial birefringence in transparent non-centro symmetric crystals under the influence of an electric field) are called electro-optic modulators.

Although the phenomenological theories of these macroscopic tensor properties of photoelastic and electro-optic behavior in crystals have been formulated by F. Pockels, (1880-1895). i.e., about a hundred years ago, it is only during the last 20 years, especially with the advent of lasers, that the technological applications of these effects in industry have been realized and today optical devices involving light modulators and deflectors are being used in industry; further exploration of applying these devices in technology is in progress

For the purpose of studying these twin topics of photo-elastic and electro-optic behavior of crystals and their figures of merit, investigators have developed special techniques as warranted by other physical properties of the crystals studied. Limitations in the Mueller's method of determination of the elasto-optic constants affects the evaluation of the elasto-optic behavior of the crystals which in turn affects the figures of merit. Furthermore, a knowledge of the specific directions in a crystal along which purely longitudinal and purely transverse acoustic waves are propagated is of immense use in arriving at the order of accuracy of the elastic constants c_{ij} $(i \neq j)$ of all crystal systems which influences the order of accuracy of the acousto-optic and electro-optic figures of merit. It has also been found that doped crystals exhibit an enhanced electro-optic behavior. The above aspects will be reviewed in detail.

07.9–9 **INVESTIGATIONS OF THE STRUCTURE OF AMORPHOUS CARBON WITH DIAMOND PROPERTIES.** By H.Grigoriew - OBREP, Warszawa, Poland and A. Sokołowska - Institute of Materials Science a. Eng. Warsaw Technical University. Warszawa, Poland.

The investigations were carried out on carbon which had been obtained under a pressure of 20 Pa and at a temperature of 300°K i.e. in the conditions where diamond is a termodynamically unstable phase /M.Sokołowski et al. J.Crystal Growth 47/1979/421/. The properties of this carbon are similar to those of diamond ($\rho \geqslant 10^8 \Omega$ m, $E_g \geqslant 3.5$ eV). This fact raises understandable doubts and there seems to be the need for a very precise analysis of the structure of this material. This carbons' thin layers, $\leqslant 10^3$ Å thick, show fine-crystalline structure in electron diffraction. Diffraction line broadening and morphological observations in TEM indicate, that the diameter of the crystallites is about 10 Å. Most often diffraction lines of diamond can be observed, in some samples those of graphite or those of Lonsdaleite. Layers$>10^4$ Å thick are amorphous in X-ray diffraction with a few weak crystalline reflections of diamond and graphite. The RDF of the material was carried out using $K\alpha_{Mo}$ on a O-500 type Siemens diffractometer, eliminating Compton scattering from part of the angle range by means of a Si[Li] counter. The interatomic distances which could be assigned to various crystallographic types of carbon were determined from the RDF, but they were, however, closer to those specific of diamond; moreover, in case of graphite no maxima should occur for r=5.4 and 5.9 Å.

sample	1.54	2.58	ok.3.1	3.67	4.10-4.4
diamond	1.55	2.52	2.96	3.56 3.89	4.12 4.36
graphite	1.42	2.45	2.84	3.74	4.27

4.9	5.4	5.9	6.3
4.63 4.83 5.04	5.27 5.67	5.85 6.00	6.18 6.37
4.96 5.1			6.2

The distance of 2.58 Å is the distance between the extreme atoms in a "boat" type ring, formed from carbons with sp^3 bonds. The material shows weakly ordered distribution, e.g. the height of the first maximum is about 5 times as small on the G/r/ curve compared with that of young hard coal, whereas the effects of ordering vanish for 7 Å, approximately. These results suggest that in the matrix of weakly bonded carbon there are fragments of the diamond lattice, which also contains "boat" type rings. After sintering this material in Ar at a temperature of 1000 K for 1 hour the amorphous phase and graphite reflections were found to have vanished. Diffraction reflections of cubic carbon occurred instead, which seems to be the final argument for the fact that in the amorphous phase there are fragments of a diamond lattice.