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Elastizität von piezoelektrischen und seignetteelektrischen Kristallen

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ZUR ERLANGUNG

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GENEHMIGTE

PROMOTIONSARBEIT

VORGELEGT VON

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Elastizität von piezoelektrischen und seignetteelektrischen Kristallen

von **Franco Jona** (ETH. Zürich).

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Summary. The object of the present investigation is the application, to piezoelectric and ferroelectric crystals, of the SCHAEFER-BERGMANN method for the measurement of the elastic constants of transparent bodies by observing the diffraction of light on supersonic waves. The elastic behaviour of Rochelle salt is investigated as a function of temperature in the range between -50^0 C and $+30^0$ C. All elastic constants, with the exception of c_{44}, turn out to behave quite normally in the investigated temperature range. The constant c_{44} could not be measured because of the very strong damping which affects the corresponding elastic wave and leads to an incomplete diffraction pattern for light incident along the ferroelectric a-axis. The agreement between the values of elastic constants measured by the author and those given by the literature for room temperature is highly satisfactory.

The elastic behaviour of the ferroelectric crystals KD_2PO_4 and RbH_2PO_4 as well as of the piezoelectric crystal $NaClO_3$ is investigated by the same supersonic method. The measurements obtained with $NaClO_3$ yield an excellent agreement with the results of MASON.

The application of the SCHAEFER-BERGMANN method to the ferroelectric crystals investigated here raises the point whether one obtains in this way the elastic constants at constant electric field (c_{ik}^E) or the elastic constants at constant dielectric displacement (c_{ik}^D). A theoretical argument shows that the constants c_{ik}^E are obtained. This conclusion confirms the results obtained by ZWICKER with KH_2PO_4, according to which the constant c_{66}, as measured by the SCHAEFER-BERGMANN method, is subject to a strong anomaly at the Curie point.

Finally some particular questions connected with the intensity of the observed diffraction patterns are discussed. The non-observation of certain figures predicted by theory for the diffraction pattern is explained. Further, an explanation is given on the basis of an elasto-optical argument for the experimentally observed fact that with equal excitation of a KH_2PO_4-crystal a much stronger diffraction pattern is obtained with light incident along the optical c-axis than with incidence parallel to the a-axis.

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