10
Concluding Remarks

Building upon the main features of crystals physics presented in this book, the interested reader should have little problem in analyzsing and handling most of the other phenomena which were only touched upon or completely left out in the text. In such cases one first has to clarify the question of inducing and induced quantities as well as their mathematical relationship. One must check whether a tensorial or non-tensorial property is present, and which characteristic symmetry results from the relationship. The influence of the symmetry properties of the crystal then follows from the rules of symmetry reduction when working with tensors, or with the help of symmetry matched functions. When looking for simple observation- and measurement arrangements, the aspects of ""longitudinal effect" and " "transverse effect" should be in the foreground. However, this only addresses one area of crystal physics today. The fundamental question as to the structural interpretation of the properties, especially the explanation of the observed anisotropy effects falls into the area of crystal chemistry and could not be covered here in any detail. This also includes the problem of which extreme values of the properties are attainable at all. Here, for example, we ask for the largest attainable heat conductivity, the lowest velocity of light, the largest pyroelectric or piezioelectric effect in crystals. Such considerations come to the fore in " "chemical engineering"," i.e., the constructive search for crystals with novel or improved properties. Therein exists one of the most important challenges of modern materials research. The acquisition of crystal–physical data and often also the resulting application depends decisively on the size and quality of the available crystals. The collective of crystals available for measurements and applications could be substantially increased, if it were possible to further miniaturize the already existing methods, i.e., to achieve a reduction in the required dimensions of the crystal specimens. This aspect plays, for example, an important role in the construction of micro-miniaturized electronic and optical devices. Furthermore, by no means have the possibilities been exhausted of investigating novel material properties with the help of inhomogeneous crystalline devices, as has been utilized for a long time in semiconductor technology (inhomogeneous doped mixed crystals, heterogeneous mixed crystals, crystals

Physical Properties of Crystals. Siegfried Haussühl.

ISBN: 978-3-527-40543-5

with inhomogeneous defect distribution). The same applies to the configuration of the geometric boundary of the devices and the application of inhomogeneous boundary conditions, as well as to the effects of inhomogeneous inducing quantities, such as, for example, from torsional stresses, which lead to finite gradients of the deformation tensor and thus to certain higher- order effects.

Finally, more efficient data collection in the future requires a more vigorous development of automatic measurement methods. There can be no doubt that the prospective material scientist awaits diverse and highly interesting tasks in all these fields.