

Preface

Crystallography constantly enjoys a new youth, thanks in particular to the spectacular progress in X-ray sources (synchrotron radiation from dedicated facilities and, very recently, free electron X-ray lasers), which make it possible to investigate an extremely broad range of materials. Its contribution is vital in many scientific and technological areas. It makes it possible, for example, to understand, and even to predict the properties of materials as diverse as high- T_c superconductors, high performance magnets, or biological materials such as proteins. The pharmaceutical industry invests large funds to set up data banks of structures, determined in the crystallized state, of molecules which could become medicines, in order to correlate their configuration to their healing action. Crystallography also is very important in nanoscience, since some materials, when prepared in the form of nano-objects, take on crystal structures which do not exist in the bulk and which necessarily affect their physical and chemical properties. Geophysicists obtain major information about the Earth mantle by investigating crystallized materials under extreme temperature and pressure conditions. In technology, we must mention structural wonders such as thin film based artificial crystals (multilayers and superlattices) of semiconductors or magnetic materials. These have for several years been present in the giant or tunnel magnetoresistance read heads of the hard drives in all our computers.

On the other hand, understanding the relation between the structure and the macroscopic properties of crystals opens the way to the use of physical properties with many applications. Thus piezoelectricity, *i.e.* the production of an electrical voltage under the effect of stress, is the basis of our quartz watches and plays a central role in cell phones. Electro-optical effects, the change in refractive indices under the effect of an electric field, entail a change in light propagation in materials.

This book is mostly a translation of *Symétrie et propriétés physiques des cristaux*, published by EDP Sciences, Orsay, France in 2011. It provides the fundamentals underpinning all these research and application areas.

In the first part, it describes in a clear and thorough way the periodicity of crystals and their symmetry, both at the microscopic level (space groups) and at the macroscopic level (point groups). It includes a presentation of the crystallography of two-dimensional systems such as surfaces and interfaces.

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Malgrange, C.; Ricolleau, C.; Schlenker, M.

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