The structure and applications of quartz

Given the remarkable properties of quartz, studies into inst structure were quick to begin; several models were suggested for its molecular arrangement. Its complexity however meant that its structure was not determined before 1925, by W.L. Bragg and R.E. Gibbs.

Pierre and Jacques Curie and their parents
Source : Evelyne Bouquet

A spiral staircase arrangement

All the atoms in quartz are interlinked by the short bonds between silicon and oxygen, giving it a spiral atomic arrangement (helix). This spiral staircase effect lies at the origin of its chiral properties and its facility to polarise light. The spirals (helix) have two possibilities for rotation, to the left and to the right. This quartz structure is found in all natural microcrystalline forms of silica, and there are many of them...

The piezoelectric properties of quartz

It was Jacques and Pierre Curie who discovered piezoelectricity in quartz – its capacity to transform a force into electricity and vice versa. The discovery only attracted the interest of physicists at first, but it was later to result in a variety of applications, first in quartz and then in other piezoelectric materials.

Sonars and quartz watches,...

Piezoelectricity is used in sonar technology, and quartz timepieces, as well as to define with precision the frequencies of all electronic devices (telephones, computers, GPS, ...).

The Curies' quartz balance

The discovery of piezoelectricity led the Curie brothers to build a generator of specific quantities of electrostatic charges: this is the Curie electrometer built by Bourbouze in 1890. The unit is built around a thin plate of quartz cut in a special way. Each side of the plate is covered with a sheet of metal which collects the electric charge generated by traction on the plate.

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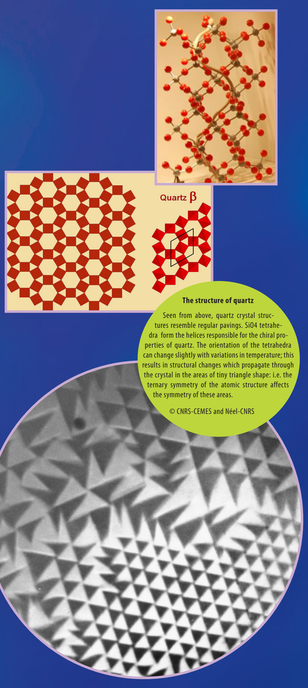

The structure of quartz

Seen from above, quartz crystal structures resemble regular pavings. SiO4 tetrahedra form the helices responsible for the chiral properties of quartz. The orientation of the tetrahedra can change slightly with variations in temperature; this results in structural changes which propagate through the crystal in the areas of tiny triangle shape; i.e. the ternary symmetry of the atomic structure affects the symmetry of these areas.

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