Conceptual Paper

Peer Nest

Rhodochrosite Optical Indicatrix

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Introduction

The name rhodochrosite is from the Greek ῥοδοχρως (ῥοδο - rose + χρως - color). It is said the inca rose designation is based on the "fact" that some of it comes from stalctitic and stalagmitic growths in silver mines worked by the ancient Incas. The electric charge that accumulates in certain solid materials, such as crystals, certain ceramics, and biological matter such as bone, DNA and various proteins) in response to applied mechanical stress, phenomenon called piezoelectricity.

The electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency is a crystal oscillator. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators. Particularly one using a quartz crystal works by distorting the crystal with an electric field, when voltage is applied to an electrode near or on the crystal. This property is known as electrostriction or inverse piezoelectricity. When the field is removed, the quartz - which oscillates in a precise frequency - generates an electric field as it returns to its previous shape, and this can generate a voltage. The result is that a quartz crystal behaves like an RLC circuit (resistor (R), inductor (L), and capacitor (C)), but with a much higher Q factor (parameter that describes the resonance behavior of an underdamped harmonic oscillator (resonator)). Quartz crystals are manufactured for frequencies from a few tens of kilohertz to hundreds of megahertz. More than two billion crystals are manufactured annually. Most are used for consumer devices such as wristwatches, clocks, radios, computers, cellphones, signal generators and oscilloscopes.

The frequencies and vibrational temperatures of the unit cell of rhodochrosite obtained by UFF were calculated in the range from 0.6059 to 1,731.38 cm^{-1} and 0.87 to 2,491.06 K, respectively. But other crystals such as rhodochrosite also have piezoelectric properties. The rhodochrosite as crystal oscillator for being an alternative to those of quartz. The rhodochrosite ($MnC0_3$) shows complete solid solution with siderite ($FeC0_3$), and it may contain substantial amounts of Zn, Mg, Co, and Ca.

The optical properties of rhodochrosite as refractive index: n_ω = 1.814 - 1.816 n_ε = 1.596 - 1.598, birefringence δ = -0.218 and mass 114.95 g/mol.

Optical properties Uniaxial (-) if the ray, whose waves vibrate in the basal plane is called the ordinary (n_ε) ray whilst the ray whose waves vibrate in a principal section is called the extraordinary (n_ω) ray and if the mineral is optically negative the indicatrix will be shaped like an oblate spheroid.

The optical indicator of rhodochrosite is given by:

$$\frac{A_x^2}{n_\alpha^2}+\frac{A_y^2}{n_\beta^2}+\frac{A_z^2}{n_\gamma^2}=1$$

$$n_\alpha^2=n_\beta^2=n_\omega^2 \; and \; n_\gamma^2=n_\varepsilon^2$$

$$\frac{A_x^2+A_y^2}{n_w^2}+\frac{A_z^2}{n_\varepsilon^2}=1$$

$$\frac{n_\varepsilon^2\left(A_x^2+A_y^2\right)+n_\omega^2 A_z^2}{n_\omega^2 n_\varepsilon^2}$$

$$n_\varepsilon^2\left(A_x^2+A_y^2\right)+n_\omega^2 A_z^2=n_\omega^2 n_\varepsilon^2$$

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$$n_\varepsilon^2\left(A_x^2+A_y^2\right)+n_\omega^2 A_z^2-n_\omega^2 n_\varepsilon^2=0$$

$$\frac{A_x^2}{1.814^2}+\frac{A_y^2}{1.814^2}+\frac{A_z^2}{1.596^2}=1$$

$$\frac{A_x^2+A_y^2}{1.814^2}+\frac{A_z^2}{1.596^2}=1$$

With center = (0, 0, 0); Volume = 21.9987; Area = 38.0807; Centroid = (0, 0, 0) Figures (1-2).

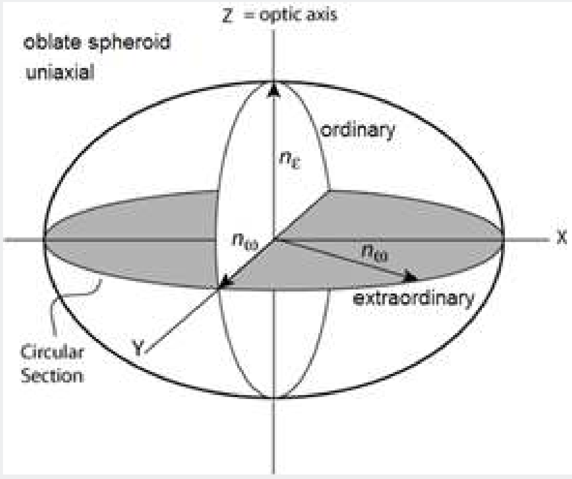

Figure 1: Representation of an ellipsoid.

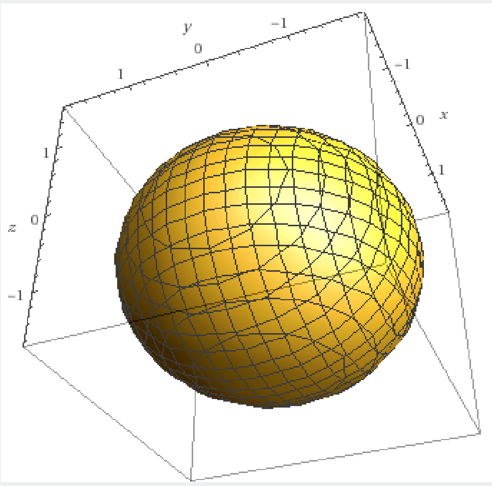

Figure 2: Representation of prolate ellipsoid obtained with rhodochrosite optical properties.