HIGHER ORDER TEMPERATURE COEFFICIENTS OF THE ELASTIC STIFFNESSES AND COMPLIANCES OF ALPHA-QUARTZ

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Abstract

The first-, second-, and third-order temperature coefficients of the elastic stiffnesses and compliances of alpha-quartz have been determined using thickness modes of double-rotated quartz plates based on the Christoffel theory of thickness vibrations. The temperature dependence of all possible thickness modes can be calculated from the values of the elastic stiffnesses and their temperature coefficients as derived during this investigation. A curve showing the locus of the first-order zero temperature coefficient of frequency of thickness-shear modes has been calculated and compared with experiments. The second- and third-order temperature coefficients of frequency of the first-order zero quartz cuts are given. Applications to AT, BT, CT, and DT cuts are made by comparing the calculated with the experimental values which characterize the frequency temperature behavior of crystals.

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