

## Visualization of Thermal Crystals Expansion

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Thermal properties of crystals can be visualized using the indicatory surfaces of thermal expansion. Radius-vector of this surface is proportional to the size of the relative lengthening of crystal in this direction at heating. The form and orientation of the indicatory surfaces of thermal expansion of the crystals is related to their symmetry according Neumann's Principle: for the crystals of the highest category – a sphere, fig.1(a); for the middle category – spheroid, fig.1(b); for the lowest category – a triaxial ellipsoid, fig.1.

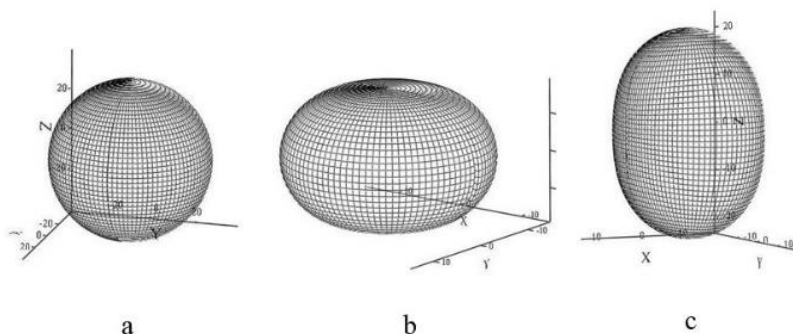


Figure 1 – The indicatory surface of thermal expansion of sphalerite (a),  $\alpha$ -quartz (b) and brookite (c), constructed in Mathcad application package.

There are a small number of materials, which in some directions have negative coefficients of thermal expansion (for example: calcite, graphite). In such crystals there are directions, which are not exposed to temperatures – cones of zero expansion.

1. W.A. Wooster, *Tensors and group theory for the physical properties of crystals* (Oxford: Clarendon Press: 1973).
2. N.V. Perelomova, M.M. Tagiyeva, *Book of problems in crystal physics* (Moscow: Science: 1982).