

Exercises N5 18.03.2025

5.1 There is a tensor which describes some property of a material:

$$T_{ij} = \begin{pmatrix} 2 & 1 & 0 \\ 1 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

Find the full set of symmetry operations that do not change this tensor. What is the symmetry of the property described by this tensor?

5.2 Find the structure of the tensor of dielectric permittivity for a material of symmetry $\frac{4}{m}$.

Show that the symmetry of the corresponding physical property (linear dielectric response) is

$$\frac{\infty}{m}.$$

5.3 Consider a tensor of stiffness c_{ijkl}

- a) Show that, in class $\bar{4}$, $c_{61} = -c_{62}$.
- b) Show that, in class 422 , $c_{61} = c_{62} = 0$.

5.4 In hexagonal crystals, $c_{66} = \frac{c_{11} - c_{12}}{2}$. This information is enough to find the relation between

s_{66} , s_{11} , and s_{12} in hexagonal crystals. Find this relation.

Hint: use the fact that c_{ijkl} and s_{ijkl} are the tensors of the same rank and symmetry.

5.5 Find the relation between the stiffness coefficient c_{11} and compliance coefficients for a cubic crystal (express c_{11} in terms of compliance coefficients $s_{\alpha\beta}$)