

Assignment 9

1. Nonlinear Susceptibility

$$P_{NLi}^{(2)} = \epsilon_0 \chi_{ijk}^{(2)} E_j E_k$$

Subscripts k and j can be replaced by a single index as follows.

xx = 1, yy = 2, zz = 3, yz = zy = 4, xz = zx = 5, xy = yx = 6 $\therefore \chi_{ijk}^{(2)} \Rightarrow d_{ij}$

$$\therefore \vec{P} = \underset{\substack{\uparrow \\ 3 \times 6 \text{ matrix}}}{\tilde{d}} \cdot \begin{pmatrix} E_x^2 \\ E_y^2 \\ E_z^2 \\ z E_z E_y \\ z E_z E_x \\ z E_x E_y \end{pmatrix}$$

The d matrix expressions for various crystals are tabulated where x, y and z are the crystal principal axes.

a) Explain why $\chi_{ijk}^{(2)} = \chi_{ikj}^{(2)}$

b) Look up the d matrix for KDP in Yariv's book.

c) What is Kleinman's conjecture? How many independent d_{ij} coefficients are left?