- how to interpret elastic parameters when they are given

for NaCl @ STP $E_{11} = 49\ GPa$, $E_{12} = 13\ GPa$, $E_{44} = 13\ GPa$

- NaCl has a cubic crystal structure (3 ind. Par.)

- given: $\{\sigma\} = \begin{Bmatrix}\sigma_1\\ \sigma_2\\ \sigma_3\\ \sigma_4\\ \sigma_5\\ \sigma_6\end{Bmatrix} = \begin{Bmatrix}\sigma_{11}\\ \sigma_{22}\\ \sigma_{33}\\ \sigma_{23}\\ \sigma_{31}\\ \sigma_{12}\end{Bmatrix}$; $\{e\} = \begin{Bmatrix}e_1\\ e_2\\ e_3\\ e_4\\ e_5\\ e_6\end{Bmatrix} = \begin{Bmatrix}e_{11}\\ e_{22}\\ e_{33}\\ 2e_{23}\\ 2e_{31}\\ 2e_{12}\end{Bmatrix}$

then: $\sigma_{11} = \hat{E}_{1111} e_{11} + \hat{E}_{1122} e_{22} + \hat{E}_{1133} e_{33} + \underbrace{2\hat{E}_{1123} e_{23} + 2\hat{E}_{1131} e_{31} + 2\hat{E}_{1112} e_{12}}_{\text{assuming minor sym.}}$

$$\sigma_1 = E_{11} e_1 + E_{12} e_2 + E_{13} e_3 + E_{14} e_4 + E_{15} e_5 + E_{16} e_6$$

$$= " \qquad " + E_{14} 2e_{23} + E_{15} 2e_{31} + E_{16} 2e_{12}$$

because $\sigma_{11} = \sigma_1 \Rightarrow \hat{E}_{1111} = E_{11}$, $\hat{E}_{1122} = E_{12}$, $\hat{E}_{1133} = E_{13}$

$\Rightarrow 2\hat{E}_{1123} = 2E_{14} \rightarrow \hat{E}_{1123} = E_{14}$, $\hat{E}_{1131} = E_{15}$, $\hat{E}_{1112} = E_{16}$

also $\sigma_{23} = \hat{E}_{2311} e_{11} + \hat{E}_{2322} e_{22} + \hat{E}_{2333} e_{33} + 2\hat{E}_{2323} e_{23} + 2\hat{E}_{2331} e_{31} + 2\hat{E}_{2312} e_{12}$

$$\sigma_4 = E_{41} e_1 + E_{42} e_2 + E_{43} e_3 + E_{44} e_4 + E_{45} e_5 + E_{46} e_6$$

$$= " \qquad " + 2E_{44} e_{23} + 2E_{45} e_{31} + 2E_{46} e_{12}$$

because $\sigma_{23} = \sigma_4 \Rightarrow \hat{E}_{2311} = E_{41}$, $\hat{E}_{2322} = E_{42}$, $\hat{E}_{2333} = E_{43}$ & $2\hat{E}_{2323} = 2E_{44}$, $\hat{E}_{2331} = E_{45}$, $\hat{E}_{2312} = E_{46}$

$$\therefore [\mathbb{E}] = \left[\begin{array}{ccc|ccc} \hat{E}_{1111} & \hat{E}_{1122} & \hat{E}_{1133} & \hat{E}_{1123} & \hat{E}_{1131} & \hat{E}_{1112} \\ & & & & & \\ & & & & & \\ \hline \hat{E}_{2311} & \hat{E}_{2322} & \hat{E}_{2333} & \hat{E}_{2323} & \hat{E}_{2331} & \hat{E}_{2312} \end{array}\right]$$

★ $E_{11} = 49\ GPa = \hat{E}_{1111}$, $E_{12} = 13\ GPa = \hat{E}_{1122}$, $E_{44} = 13\ GPa = \hat{E}_{2323}$