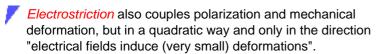
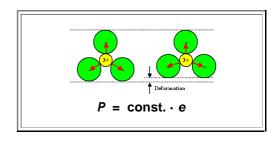
3.6.3 Summary to: Special Dielectrics

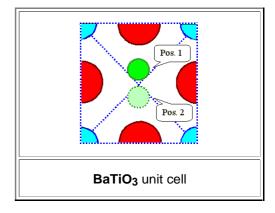
- Polarization <u>P</u> of a dielectric material can also be induced by mechanical deformation <u>e</u> or by other means.
 - Piezo electric materials are anisotropic crystals meeting certain symmetry conditions like crystalline quartz (SiO₂): the effect is linear.
 - The effect also works in reverse: Electrical fields induce mechanical deformation
 - Piezo electric materials have many uses, most prominent are quartz oscillators and, recently, fuel injectors for Diesel engines.



- The effect has little uses so far; it can be used to control very small movements, e.g. for manipulations in the nm region. Since it is coupled to electronic polarization, many materials show this effect.
- Ferro electric materials posses a permanent dipole moment in any elementary cell that, moreover, are all aligned (below a critical temperature).
 - There are strong parallels to ferromagnetic materials (hence the strange name).
 - Ferroelectric materials have large or even very large ($\epsilon_r > 1.000$) dielectric constants and thus are to be found inside capacitors with high capacities (but not-so-good high frequency performance)
- Pyro electricity couples polarization to temperature changes; electrets are materials with permanent polarization, There are more "curiosities" along these lines, some of which have been made useful recently, or might be made useful as material science and engineering progresses.



$$e = \frac{\Delta I}{I} = \text{const} \cdot E^2$$



Questionaire

Multiple Choice questions to all of 3.6