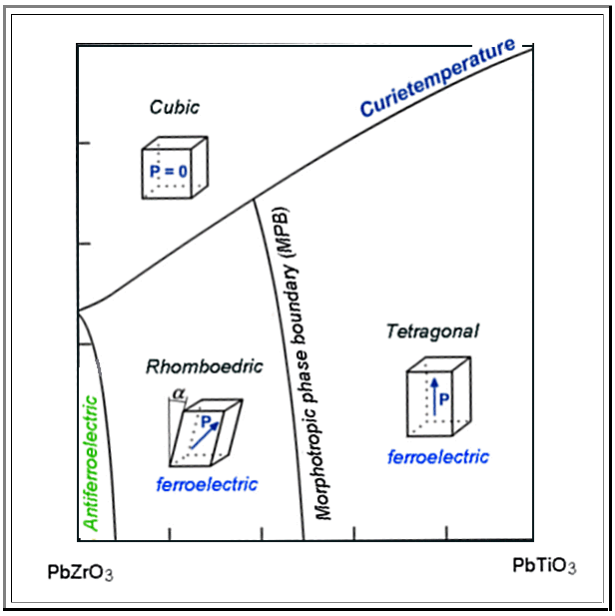
PZT or Lead-Zirconate-Titanate

Advanced

- **PZT** is short for Lead (= **P**b) zirconate (= **Z**r) titanate (= **T**i) or **$Pb[Zr_xTi_{1-x}]O_3$**. It is mixture of **$PbTiO_3$** and **$ZrTiO_3$**
  - Both constituents are Perowkites as described in the backbone. For temperatures below the Curie temperature we have spontaneous polarization as indicated in the phase diagram (adopted form Wikipedia).



- Both lattice pictures in the phase diagram are hugely exaggerated. Drawn to scale the eye would not see a difference to a perfect cube. The relation of the axis' in thetetragonal case is abour **1,06** and the angle α in the rhomboedric structure, for example, is around **0.3^o**.
  - This rather esmall distortions are large enough, however to produce major permanent polarization effects
- The interesting part is the "**morphological phase boundary**" (***MPB***) where the structure changes but not the constitutents. Several properties, most interesting for us the "dielectric constant" show pronounced maxima on the **MPB**; "theoretically" they could diverge to infinity.
  - More down to earth, a mixture of tetragonal and rhomboedric crystals have all togehter **14** possible directiopons for spontaneous polarization. In othe words, no matter what the external field direction might be, there is always an "easy" direction available in the **PZT** that is not too steeply inclined to the field direction.
- As always, optimizing the mixture and adding some other "dopants" or better alloying elements, can produce a large range of properties.