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TEM investigation of Ca-rich plagioclase: Structural fluctuations related to the $I\bar{1}$-$P\bar{1}$ phase transition

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Abstract

We used transmission electron microscopy (TEM) to understand microstructural changes accompanying the reversible $I\bar{1}$-$P\bar{1}$ phase transition in Ca-rich plagioclase as a function of Na content. The transition produces *c*- and *d*-type domains that have $P\bar{1}$ symmetries, and the symmetries of domain walls are $I\bar{1}$. Based on diffractograms and contrast differences of high-resolution TEM (HRTEM) images, we infer that structural differences occur on a scale of tens of nanometers, giving rise to structural fluctuations. These variations can be followed on a nanometer scale using HRTEM images. We propose a model with a body-centered Al-Si framework and single Ca sites for the $I\bar{1}$ domains. The $P\bar{1}$ domains of anorthite with high Al-Si ordering are homogeneous. In contrast, structural fluctuations occur in both anorthite with lower Al-Si ordering and in Na-bearing plagioclase. The magnitudes of the fluctuations decrease with increases in Na content.

Keywords: $I\bar{1}$-$P\bar{1}$ phase transition, Ca-rich plagioclase, HRTEM, structural fluctuations