

## **TEM observations on the $P\bar{1}-\bar{1}\bar{1}$ phase transition in feldspars along the join $\text{CaAl}_2\text{Si}_2\text{O}_8\text{-SrAl}_2\text{Si}_2\text{O}_8$**

**MARIO TRIBAUDINO,<sup>1</sup> PIERA BENNA,<sup>1,2</sup> AND EMILIANO BRUNO<sup>1,2</sup>**

<sup>1</sup>Dipartimento di Scienze Mineralogiche e Petrologiche, Via Valperga Caluso 35, I-10125 Torino, Italy

<sup>2</sup>Centro di Studi sulla Geodinamica delle Catene Collisionali, Via Accademia delle Scienze 5, I-10123 Torino, Italy

### **ABSTRACT**

A transmission electron microscopy (TEM) investigation was performed on Ca-rich feldspars along the join  $\text{CaAl}_2\text{Si}_2\text{O}_8\text{-SrAl}_2\text{Si}_2\text{O}_8$  (An-SrF). Two series of samples were synthesized by dry ( $T = 1450\text{ }^\circ\text{C}$ ,  $t = 96\text{ h}$ ) and hydrothermal ( $P_{\text{H}_2\text{O}} = 2\text{ kbar}$ ,  $T = 600\text{ }^\circ\text{C}$ ,  $t = 300\text{ h}$ ) annealing with compositions between  $\text{An}_{100}$  and  $\text{An}_{50}\text{SrF}_{50}$ . TEM investigation at room temperature showed the presence of sharp  $c$ -type reflections only in hydrothermal  $\text{An}_{100}$  and  $\text{An}_{80}\text{SrF}_{20}$  feldspars, whereas diffuse and elongated  $c$  reflections were found in all other feldspars in the range  $\text{An}_{80}\text{SrF}_{20}\text{-An}_{50}\text{SrF}_{50}$ . The intensity of  $c$  reflections decreases with increasing Sr content, and fully disappears only at  $\text{An}_{50}\text{SrF}_{50}$ .

In-situ, high-temperature TEM investigation (HT TEM) on hydrothermally treated  $\text{An}_{100}$  and  $\text{An}_{80}\text{SrF}_{20}$  feldspars, showed a significant decrease in the temperature ( $T_c$ ) of the  $P\bar{1}-\bar{1}\bar{1}$  phase transition with increasing Sr content. In  $\text{An}_{80}\text{SrF}_{20}$  feldspar, a precise critical temperature cannot be defined, and the transition is smeared over a  $T$  range between 100 and 150  $^\circ\text{C}$ .

A  $P\bar{1}-\bar{1}\bar{1}$  phase transition is therefore observed both as a function of composition and temperature. The transition dependence on composition is induced by the increase in the non-tetrahedral cation radius that causes a static disorder and affects the intensity of  $c$  reflections. Dynamical disorder adds to the static disorder induced by Sr across the transition at HT.