

Crystal chemistry of synthetic $\text{Ca}_2\text{Al}_3\text{Si}_3\text{O}_{12}\text{OH}$ – $\text{Sr}_2\text{Al}_3\text{Si}_3\text{O}_{12}\text{OH}$ solid-solution series of zoisite and clinozoisite

G. DÖRSAM,^{1,*} A. LIEBSCHER,^{1,2} B. WUNDER,² G. FRANZ,¹ AND M. GOTTSCHALK²

¹Technische Universität Berlin, Fachgebiet Mineralogie, ACK 9, Ackerstr. 76, D-13355 Berlin, Germany

²GeoForschungszentrum Potsdam Telegraphenberg 14473 Potsdam, Germany

ABSTRACT

Coexisting solid-solution series of synthetic zoisite-(Sr) and clinozoisite-(Sr) were synthesized in a 1 M (Ca,Sr)Cl₂ solution at 2.0 GPa, 600 °C for 6 days in a piston cylinder press. Solid solutions were synthesized from $X_{\text{Sr}}^{\text{zo}} = \text{Sr}/(\text{Ca} + \text{Sr}) = 0.06$ to 1 and $X_{\text{Sr}}^{\text{czo}} = 0.08$ to 0.5 in zoisite and clinozoisite, respectively. The products were characterized with SEM, EMP, and powder-XRD. Zoisites form crystals up to 30 μm in size. Lattice parameters of zoisite increase linearly with increasing Sr content. For synthetic zoisite-(Sr) lattice parameters are $a = 16.3567(5)$ Å, $b = 5.5992(2)$ Å, $c = 10.2612(5)$ Å, and $V = 939.78(7)$ Å³ in space group *Pnma*. Volume of clinozoisite (*P2₁/m*) increases with increasing $X_{\text{Sr}}^{\text{czo}}$, but the lattice parameter a collapses, and b , c , and β have a discontinuity at $X_{\text{Sr}}^{\text{czo}} \approx 0.25$. The decrease in angle β of clinozoisite results in compression of M3 and T3 polyhedra and increase of the A2 polyhedron. A1-O7 distance of 2.12 Å in clinozoisite is extremely short at $X_{\text{Sr}}^{\text{czo}} \approx 0.25$, but with further Sr incorporation on A2 this distance relaxes quickly to 2.24 Å, combined with a torsion of T3. In zoisite, Sr incorporation leads to an opposite movement of neighboring octahedral chains parallel a and causes changes in the linked T3, and angle O5-T3-O6 increases with X_{Sr} from 96.3 to 101°. The intra-crystalline distribution of Sr shows that A2 is the favored position and continuous incorporation on A1-position starts above $X_{\text{Sr}}^{\text{zo}} \approx 0.35$ for zoisite and above $X_{\text{Sr}}^{\text{czo}} \approx 0.45$ for clinozoisite.

Keywords: Zoisite, clinozoisite, strontium, synthesis, solid-solution series, hydrothermal, EMP data, XRD data