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Synthesis and characterization of white micas in the join muscovite–aluminoceladonite

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ABSTRACT

Potassic white micas were synthesized in the K_2O-MgO-Al_2O_3-SiO_2-H_2O system along the pseudobinary join muscovite–aluminoceladonite (mu-Alcel). Composition of run products as measured by electron microprobe analysis are in the range mu_{89}-$Alcel_{11}$ to mu_{01}-$Alcel_{99}$. Cell parameters were determined on powder samples by full-profile Rietveld refinement, using both a single-polytype and a multi-polytype model. The results of both analysis models are in full agreement, and show that the phengite cell parameters have a distinct dependence on the celadonite content: the *c* parameter shows a monotonic decrease over the full compositional range, whereas the *a* and *b* parameters both increase in the $Alcel_0$–$Alcel_{60}$ range but decrease in the $Alcel_{60}$–$Alcel_{100}$ range. The monoclinic b angle decreases slightly with increasing celadonite content. The overall behavior of the cell parameters indicates a decrease of the ditrigonal distortion of the tetrahedral 6-rings, and an increased trioctahedral character of the structure at high celadonite compositions. The molar volume along the solid solution join shows a maximum at about $Alcel_{30}$. Molar volume vs. composition can be fitted by a symmetric function for the excess volume yielding a molar volume for end member aluminoceladonite of 13.957 ± 0.006 J/bar, for muscovite 14.076 ± 0.004 J/bar, and a symmetric positive deviation from ideal volumes of mixing with W = 0.198 ± 0.025 J/bar, and r^2 = 0.941. The use of an asymmetric excess volume function does not significantly improve the fit quality (r^2 = 0.945).