

Fine structure of infrared OH-stretching bands in natural and heat-treated amphiboles of the tremolite-ferro-actinolite series

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ABSTRACT

Fine structure in the principal OH-stretching bands of amphiboles of the tremolite-ferro-actinolite series have been examined. In samples with partly filled A sites, a broad (composite) band is observed at 3725~3680 cm⁻¹ and is assigned to two types of configurations: (M1M1M3)-OH-^A(Na,K):^{T1}Si ^{T1}Al in which Al occurs at the T1 site, and (M1M1M3)-OH-^A(Na,K)-^{O3}(O²⁻,F-,Cl-); the component of (M1M1M3)-OH-^A(Na,K):^{T1}Si ^{T1}Si configuration is small, because Na and K at the A site are locally associated with Al at an adjacent T1 site. In tremolite, manganoan tremolite, and Fe²⁺-poor actinolite, a weak shoulder on the principal A band at ~3669 cm⁻¹ is assigned to the configuration ^{M4}Ca^{M4}(Mg,Fe²⁺,Mn²⁺,Na):(MgMgMg)-OH-^A□:^{T1}Si ^{T1}Si (□ = vacancy). Fine structure in the principal bands B (B' and B'') and C (C' and C'') are also observed: the higher-frequency band B'' is assigned to ^{M1}Fe²⁺^{M1}Mg^{M3}Mg-OH-^A□, and the lower-frequency band B' to ^{M1}Mg^{M1}Mg^{M3}Fe²⁺-OH-^A□; the higher-frequency band C' is assigned to ^{M1}Fe²⁺^{M1}Fe²⁺^{M3}Mg-OH-^A□ and the lower-frequency band C'' to ^{M1}Mg^{M1}Fe²⁺^{M3}Fe²⁺-OH-^A□. Some broad OH-stretching bands attributed to (M1M1M3)-OH-^A□:^{T1}Si ^{T1}Al are observed at 3640~3580 cm⁻¹. In amphiboles of the tremolite-ferro-actinolite series that show a substantial B [(MgMgFe²⁺)-OH] band, a new OH-stretching band (at around 3641 cm⁻¹), E, appears near the principal C band (at around 3643 cm⁻¹) on heat treatment. The shape of band E is similar to that of the original band B, and its local configuration is O²⁻-(MgMgFe³⁺)-OH-. A weak and broad band A** appears at ~3690 cm⁻¹ on heat treatment of some Na-bearing actinolites, and is ascribed to the (MgMgMg)-OH-^ANa-O²⁻ configuration.