Valdrè G., Malferrari D., Brigatti M.F. (2009) Crystallographic features and cleavage nanomorphology of chlinochlore: specific applications. Clays and Clay Minerals, 57(2), 183-193.
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ABSTRACT

This work firstly investigates the relationships between clinochlore cleavage characteristics, in terms of nano-morphology and surface potential, and its average crystal chemistry and topology. Secondly, it shows that the structural features of clinochlore can be successfully used to condense, order and self assemble complex biomolecules, such as DNA.

A natural IIb-4 clinochlore [$C\bar{1}$ symmetry, unit cell parameters a = 0.53301(4); b = 0.92511(6); c = 1.4348(1) (nm); α = 90.420(3); β = 97.509(3); γ = 89.996(4) (°)] with chemical composition ($Mg_{1.701}$ $Fe^{2+}_{0.245}$ $Ti_{0.004}$ $Al_{0.998}$ $Cr^{3+}_{0.052}$) Mg_3 ($Si_{2.939}$ $Al_{1.015}$ $Fe^{3+}_{0.046}$) O_{10} ($OH_{7.913}$ $F_{0.087}$) was selected. The octahedral sites of the silicate layer ($\langle$M(1) - O$\rangle$ = 0.2080 nm and $\langle$M(2) - O$\rangle$ = 0.2081 nm) are equal and occupied by Mg, whereas the octahedral sites in the interlayer M(3) and M(4) ($\langle$M(3) - O$\rangle$ = 0.2088 nm and $\langle$M(4) - O$\rangle$ = 0.1939 nm) show different size and are mostly completely occupied by divalent (Mg and Fe^{2+}) and trivalent (Al^{3+}) cations, respectively.

The clinochlore cleaved surface presents two types of patterns: (i) stripe type (~ 0.40 nm in height, up to several micrometers long and ranging from some nanometers to a few microns in lateral size), and (ii) triangular-saped-type (~0.40 nm in height). Both features may result either from interlayer sheets whose cleavage weak directions are related to the different M(3) and M(4) site occupancy, or from interlayer weak bonding along specific directions to the underneath 2:1 layer. The cleaved surface, particularly at the cleaved edges, presents high DNA affinity, which is directly related to an average positive surface and ledge potential.

Key words: *Clinochlore, crystal structure, AFM, XAS, surface applications.*