Thermal Transformation of Chrysotile Studied by High Resolution Electron Microscopy

Helena de Souza Santos and Keiji Yada

Laboratório de Microscopia Eletrônica Instituto de Física Universidade de São Paulo, São Paulo, Brazil
Institute for Scientific Measurements, Tohoku University, Sendai, Japan

Abstract: Thermal transformation of chrysotile from Uruaçu District, state of Goiás, Brazil, heated in dry conditions at temperatures from 600 ° C to 1300 ° C was studied by high resolution electron microscopy and selected area electron diffraction (SAD). Up to 600 ° C, no morphological or SAD pattern changes were observed. At 600 ° C, the fibrils were still crystalline with the characteristics of the clinochrysotile. In addition, a new fringe system of 10 – 15 Å spacings appeared sporadically parallel to the 7.3 Å fringes of chrysotile. Areas of these extra fringes seem to constitute favorable sites for the nucleation of forsterite. At 650 ° C, forsterite nuclei appeared inside the nearly amorphous fibrils in the shape of patches consisting of flaky crystallites. At 700 ° C the chrysotile structure had disappeared; the new spots present in the SAD pattern were indexed as those of forsterite. Between 800 – 900 ° C the crystallinity of the patches was clearly demonstrated. From the lattice images in the patches, topotactic relations between chrysotile and forsterite were analyzed. At 1000 ° C very tiny grains of enstatite were formed mixed with forsterite grains. The SAD pattern is complex due to the coexistence of forsterite, enstatite, and silica-rich amorphous areas. From 1100 ° C to 1300 ° C the tridimensional growth of enstatite was promoted. The present results support the topotactic relations between chrysotile and forsterite found by X-ray analysis although differences up to several degrees may exist when these phases are observed microscopically. Evidence suggesting a topotactic growth between forsterite and enstatite was also obtained.

Key Words: Asbestos • Chrysotile • Electron Microscopy • Enstatite • Forsterite • Lattice-imaging • Selected Area Diffraction

Clays and Clay Minerals; June 1979 v. 27; no. 3; p. 161-174; DOI: 10.1346/CCMN.1979.0270301

Clay Minerals Society (www.clays.org)