

## Study of the Dehydroxylation-Rehydroxylation of Pyrophyllite by Spectrometric and Thermal Analysis Methods

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Pyrophyllite is a 2:1 aluminosilicate [Al<sub>2</sub>Si<sub>4</sub>O<sub>10</sub> (OH)<sub>2</sub>] clay that has a dioctahedral layer structure with an octahedrally coordinate Al ions sheet in-between two sheets of SiO<sub>4</sub> tetrahedra. The applications of pyrophyllite are due to its good technological properties produced by thermal treatment. Thus, it has been mainly used as a ceramic raw material in refractory industry for applications such as insulating firebrick or foundry specialities and also in various white-ware bodies.

The investigation of the dehydroxylation reaction of clay minerals is important both from theoretical and technical aspects. The dehydroxylation of pyrophyllite has been described as a homogeneous process involving reaction of two cis-OH group with the liberation of water. It has been suggested that the pyrophyllite dehydroxylate consists of 5-coordinate, distorted, trigonal bipyramidal AlO<sub>5</sub> structural units in the aluminium oxide layer sandwiched between two distorted tetrahedral silica layers. <sup>27</sup>Al NMR-MAS studies have shown the 6 coordinated Al in pyrophyllite change their structural arrangement to 5 coordinate Al in pyrophyllite dehydroxylated. <sup>29</sup>Si MAS-NMR data have confirmed that pyrophyllite dehydroxylate maintains the 2:1 layer structure. The formation of 5-coordinate aluminium sites in pyrophyllite dehydroxylate is consistent with the homogeneous reaction of the adjacent OH groups to liberate water and the formation of a bridging oxide midway between adjacent aluminium atoms. Recently, the dehydroxylation of pyrophyllite has been studied using infrared spectroscopy [1]. Thus, it has been found that the dehydroxylation process is characterized by a decrease in the intensity of the OH signals and phonon bands of pyrophyllite as well as the appearance of two additional signals at 3690 and 3702 cm<sup>-1</sup> for samples annealed in the temperature range from 550 to 900 °C. These authors suggested that the dehydroxylation of pyrophyllite is a two-stage process, appearing an unknown intermediate state during the dehydroxylation of pyrophyllite. In this work we have studied the dehydroxylation of pyrophyllite using spectrometric and thermal analysis experimental methods to clarify the mechanism of dehydroxylation, and the possible rehydroxylation, of pyrophyllite.

[1] L. Wang, M. Zheng, S.A.T. Redfern and Z. Zhang, *Clays and Clay Minerals* 50 (2002) 272-283.