American Mineralogist, Volume 92, pages 151–165, 2007

Crystal-chemistry of synthetic K-feldspar–buddingtonite and muscovite–tobelite solid solutions

BIRGIT PÖTER, MATTHIAS GOTTSCHALK,* AND WILHELM HEINRICH

GeoForschungsZentrum, Department 4, Telegrafenberg, D-14473 Potsdam, Germany

ABSTRACT

Experiments in the system K_2O-$(NH_4)_2O$-Al_2O_3-SiO_2-H_2O-HCl have been conducted between temperatures of 400 and 600 °C at pressures of 200, 400, 500, and 1500 MPa. The run products consisted of solid solutions of the K-feldspar–buddingtonite, muscovite–tobelite series, and quartz. The run products were characterized by electron microprobe, powder X-ray diffraction with Rietveld analysis, and infrared spectroscopy. It can be shown that complete solid solution exists for both series for temperatures at least above 400 °C. The grain size of the synthesized phases was usually small and rarely exceeded 10 μm. In addition the micas were quite thin and the thickness was lower than 100 nm. Due to the small grain size and the $(NH_4)_2O$-content, reliable electron-microprobe results were difficult to obtain. Rietveld analyses did show that the synthesized micas consisted of a complex mixture of 1*M,* 2*M*1*,* 2*M*2*,* 3*T,* and 2*Or* polytypes. The lattice parameters of the feldspar and mica solid solutions are linear combinations of the end-members and show practically no excess volume. Reasonable compositions of the solid solutions can be derived from the lattice parameters. The mica solid solutions are not binary mixtures but at elevated pressure increasing amounts of pyrophyllite component were observed. By using the NH_4-deformation mode at around 1430 cm^{-1} and the OH-stretching vibrations ν_{OH} at 3600–3700 cm^{-1} the NH_4-contents of the micas could be determined also by IR spectroscopy.

Keywords: Chemical analysis, K-NH_4 feldspar, mica, IR spectroscopy, experimental petrology, feldspar