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$(H_3O)Fe(SO_4)_2$ formed by dehydrating rhomboclase and its potential existence on Mars

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Abstract

Rhomboclase, $(H_5O_2)Fe(SO_4)_2 \cdot 2H_2O$, transforms to a solid crystalline phase, $(H_3O)Fe(SO_4)_2$, upon dehydration. The structure of $(H_3O)Fe(SO_4)_2$ is found to be the same as a recently reported structure determined from single-crystal diffraction by Peterson et al. (2009), who synthesized the same compound using a hydrothermal method. The phase boundary between rhomboclase and $(H_3O)Fe(SO_4)_2$ as a function of temperature (*T*) and relative humidity (RH) was determined by environment-controlled in situ X-ray diffraction (XRD) method. The stability of $(H_3O)Fe(SO_4)_2$ against rhomboclase was further evaluated under a simulated martian condition (constant 50% RH, –20 °C, 6 mbar CO_2). Both phases remained after 14 days with no observable transition. This result suggests that hydrate ferric sulfate minerals might not respond to diurnal RH fluctuation under the extremely slowed kinetics expected on the martian surface.

Keywords: Rhomboclase, sulfate, hydrate, humidity, Mars, ferric sulfate