Inhibition of Sintering by Si During the Conversion of Si-Rich Ferrihydrite to Hematite

Susan M. Glasauer[1,†], Paul Hug[2], Peter G. Weidler[3] and Andreas U. Gehring[3]

[1] Lehrstuhl für Bodenkunde, Technische Universität München, 85350 Freising-Weihenstephan, Germany
[2] Institut für Anorganische Chemie, Universität Zürich, CH-8057 Zürich, Switzerland
[3] Institut für Terrestrische Ökologie, ETH Zürich, CH-8952 Schlieren, Switzerland

[†] Present address: Department of Microbiology, University of Guelph, Guelph, Ontario, N1G 2W1, Canada. E-mail of corresponding author: sglasaue@micro.uoguelph.ca

Abstract: The distribution and chemical state of Si in a synthetic 2-line ferrihydrite with a Si/(Si + Fe) molar ratio of 0.11 was studied. Heat treatment under oxidizing conditions shows that Si-rich ferrihydrite is stable to 400 ° C. The transformation to hematite and the formation of a polymerized amorphous-silica phase occur at 850 ° C. At this temperature, the specific surface area decreases greatly and the average pore diameter increases, which is indicative of sintering. Heating under severe reducing conditions causes a segregation of Si from Fe and results in a mixture of elemental Fe and SiO_2. Surface and structural data suggest that Si is located near the particle surface where it limits the rearrangement of Fe octahedra to form hematite.

Key Words: BET • Ferrihydrite • Si • Sintering • XPS

Clays and Clay Minerals; February 2000 v. 48; no. 1; p. 51-56; DOI: 10.1346/CCMN.2000.0480106

Clay Minerals Society (www.clays.org)