
Photochemical Dissolution of Goethite in Acid/Oxalate Solution

R. M. Cornell and P. W. Schindler

University of Berne, Institute of Inorganic Chemistry, Freiestrasse 3 CH-3000 Berne 9, Switzerland

Abstract: During photochemical dissolution of goethite in acid/oxalate solution, Fe^{3+} , Fe^{2+} , and CO_2 were released and towards the end of the reaction ferrous oxalate precipitated. The dissolution process involved an initial slow stage followed by a much faster reaction. The slow stage was eliminated by addition of 20 ppm Fe^{2+} to the system at the start of the reaction. The presence of this Fe^{2+} did not accelerate the secondary dissolution process. Both protons and oxalate ions appear to have been involved in the dissolution process. Dissolution was accelerated by an increase in oxalate concentration (from 0.0025 to 0.025 M) in the system and also depended on pH, reaching a maximum rate at pH 2.6. Highly substituted (15.9 mole % Al) goethite dissolved more slowly per unit area than unsubstituted goethite. Lepidocrocite ($\gamma\text{-FeOOH}$) dissolved faster than goethite. The first stage of the dissolution process probably proceeded by slow release of Fe^{3+} through complexation with oxalate adsorbed on the goethite surface. The faster, secondary step appears to have been a reductive dissolution reaction involving adsorbed ferrous oxalate.

Key Words: Goethite • Iron • Lepidocrocite • Photochemical dissolution • Oxalate

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