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# Properties of Goethites of Varying Crystallinity

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**Abstract:** Goethites were synthesized from ferrihydrite in 0.7 M KOH between 4° and 90° C. As temperatures increased, the goethite crystals became larger and of less domainic character, and surface areas decreased from 153 to 9 m<sup>2</sup>/g. Surface area, oxalate-soluble Fe to total Fe ratios, chemisorbed water, Mössbauer parameters, and dissolution rate in 6 M HCl at 25° C are particle-size controlled, whereas mean crystallite dimensions, *a*-dimension of the unit cell, differences between the two OH-bending modes, and dehydroxylation temperatures suggest the existence of a low-temperature (high-*a*-dimension) and a high-temperature (low-*a*-dimension) goethite, with a narrow transition range at a synthesis temperature of 40° – 50° C. Hydrothermal treatment at 125° – 180° C of a low-temperature goethite led to a healing of the multidomainic, microporous high-*a*-dimension goethite into a monodomainic low-*a*-dimension goethite of similar overall crystal size with the properties of a low-*a*-dimension goethite.

**Key Words:** Crystallinity • Dissolution • Goethite • Hydrothermal treatment • Iron • Unit-cell dimension • X-ray powder diffraction

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