
A Structural Model for Natural Siliceous Ferrihydrite

R. L. Parfitt¹, S. J. Van der Gaast² and C. W. Childs¹

¹ Landcare Research NZ, Private Bag 31902, Lower Hutt, New Zealand (formerly DSIR Land Resources)

² Netherlands Institute for Sea Research, P.O. Box 59, Texel, The Netherlands

Abstract: X-ray diffraction of four natural samples of ferrihydrite indicates the presence of crystalline domains within the primary particles. The average diameter of the primary particles (determined from low-angle powder patterns) decreases from 4.1 nm to 2.5 nm as the domain size in the xy-plane (determined by applying the Scherrer equation to the broad [110] XRD peak at 0.26– 0.27 nm) decreases from 1.0 nm to 0.77 nm. The Si content (measured by acid-oxalate extraction) increases from 4.1% to 6.1% as both the domain and particle sizes decrease; other factors, however, are likely to be important in influencing particle size. For one sample of ferrihydrite, the smallest possible domain (i.e., $c = 0.94$ nm in the z-direction) contains 36 O atoms and three Si atoms. A model for ferrihydrite is suggested in which silicate bonds to, and bridges, the surfaces of the domains. The model can account for several aspects of the behavior of siliceous ferrihydrites.

Key Words: Domain size • Ferrihydrite • Low-angle X-ray diffraction (LAXRD) • Particle size • Silicate • Structure • X-ray diffraction (XRD)

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