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Structure of synthetic 6-line ferrihydrite by electron nanodiffraction

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ABSTRACT

Single-crystal electron diffraction patterns of nanocrystals in two samples of synthetic six-line ferrihydrite (6LFh) were obtained using electron nanodiffraction to produce diffraction patterns from areas between ~0.7 and 5 nm across. One of the samples was synthesized at 75 °C by a conventional method; the other was synthesized by a recently developed room-temperature technique. Structures of individual nanocrystals were investigated by comparing experimental and simulated electron-diffraction patterns. The most common structure in each sample is based on double-hexagonal (ABAC) stacking of close-packed oxygen layers, and is similar to the "defect-free ferrihydrite" structure proposed by Drits and co-workers. Nanocrystals with maghemite- or magnetite-like structures and structures similar to those in two-line ferrihydrite (2LFh) occur less commonly in both samples. The sample synthesized at room temperature has a small amount of hematite, which was not found in nanodiffraction patterns from the 75 °C sample. The most common structure in 6LFh is distinct from those previously determined by nanodiffraction of 2LFh, indicating that 6LFh is not simply a more crystalline form of 2LFh.