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# Transmission Electron Microscopy of Synthetic 2- and 6-Line Ferrihydrite

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**Abstract:** High-resolution transmission electron microscopy (HRTEM), selected-area electron diffraction (SAED), annular dark-field scanning transmission electron microscope (STEM) images, and electron nanodiffraction were used to examine structures of synthetic 2- and 6-line ferrihydrite specimens. HRTEM images of 2-line ferrihydrite (2LFh) show scattered small ( $\sim 1-3$  nm) areas with lattice fringes surrounded by areas free of fringes. All SAED patterns show two bright rings corresponding to  $d$ -values of  $\sim 0.15$  and  $0.25$  nm; each ring has a conspicuous shoulder on each side. Faint rings corresponding to  $d$ -values of  $0.08$ ,  $0.095$ ,  $0.100$ ,  $0.106-0.114$  (very broad ring), and  $0.122$  nm are visible in strongly exposed SAED patterns. Nanodiffraction patterns show conspicuous streaks and a lack of superlattice formation.

HRTEM images of 6-line ferrihydrite (6LFh) display larger crystallites (typically  $\sim 5-6$  nm) with lattice fringes visible in many thin areas. SAED patterns show rings corresponding to  $d$ -values of  $0.148$ ,  $0.156$ ,  $0.176$ ,  $0.202$ ,  $0.227$ , and  $0.25-0.26$  nm and a shoulder extending between  $d$ -values of  $\sim 0.25$  and  $0.32$  nm. Faint rings corresponding to  $d$ -values of  $0.086$ ,  $0.093$ ,  $0.107$ ,  $0.112$ ,  $0.119$ ,  $0.125$ , and  $0.135$  nm are visible in strongly exposed SAED patterns. Small quantities of hematite, magnetite or maghemite, and an acicular material tentatively identified as goethite were observed in the 6-line ferrihydrite, but these quantities do not contribute significantly to the overall diffracted intensity from the sample.

**Key Words:** Ferrihydrite • High-Resolution Transmission Electron Microscopy (HRTEM) • Nanodiffraction • Selected-Area Electron Diffraction (SAED)

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