TIME RESOLVED SYNCHROTRON X-RAY POWDER DIFFRACTION STUDY OF BIOGENIC NANO-MAGNETITE.

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Abstract

The bacterium *Geobacter sulfurreducens* can produce nanoparticulate magnetite (Fe_3O_4) by the reduction of amorphous Fe(III) oxyhydroxide coupled to the oxidation of organic matter in the anoxic subsurface as an alternative to oxygen respiration. *G. sulfurreducens* can transfer electrons to solid Fe(III)-bearing minerals through either direct contact between the cell and the mineral surface or by using an electron shuttling compound. High-resolution synchrotron X-ray powder diffraction has been used to study samples taken at different stages of this reaction. This shows that an initial amorphous phase first transforms to goethite (FeO(OH)), before undergoing a further transformation to magnetite. Magnetite is formed faster in the presence of the electron shuttling compound disodium anthraquinone 2,6 disulphonate.