

Fe(II)-Bearing Clay Minerals Accelerate Ferrihydrite Transformation

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Aqueous Fe^{2+} -accelerated ferrihydrite transformation to more crystalline minerals has been well documented. Whereas, it remains unexplored whether and how solid Fe(II) in clay minerals accelerates ferrihydrite transformation since ferrihydrite often coexists with Fe(II)-bearing minerals in soils and sediments. Here we show that reduced nontronite N_{Au-2} and Wyoming montmorillonite S_{Wy-2} accelerated ferrihydrite transformation to lepidocrocite under neutral and anoxic conditions. At the ratio of 0.6 mM $\text{Fe(II)}_{\text{N_{Au-2}}/\text{g}$ ferrihydrite, about 86% of ferrihydrite was transformed to lepidocrocite within 72 h, and Fe(II) in reduced N_{Au-2} was oxidized. Morphology observations reflected that ferrihydrite transformation occurred mainly on the basal planes and partially on the edges of reduced N_{Au-2}. A series of control experiments corroborated that solid Fe(II) in reduced N_{Au-2} was mainly responsible for ferrihydrite transformation. The mechanism of ferrihydrite transformation is attributed to the interfacial electron transfer from structural Fe(II) in clay minerals to ferrihydrite with formation of ferrihydrite-sorbed Fe(II). Our findings extend the species of Fe(II) for accelerated ferrihydrite transformation from aqueous Fe^{2+} to Fe(II)-bearing clay minerals solid and highlight the importance of the interfacial redox reaction between iron (oxyhydr)oxides and Fe(II)-bearing clay minerals.