296 - Cation effects on Mn^{2+} oxidation by nanoparticulate d-MnO_2

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$Mn^{(III,IV)}$-oxides can coexist with dissolved Mn^{2+} in the environment, such as in a redox reaction where Mn^{2+} is produced by $Mn^{(III,IV)}$ reduction or oxidized to form $Mn^{(III,IV)}$-oxides. In this study, d-MnO_2, a nanoparticulate layered $Mn^{(IV)}$-oxide, was reacted with 1 mM Mn^{2+} at pH 7.8 in a stirred-flow reactor in the presence of Na^+ (50 mM), Ca^{2+} (16.7 mM), Ni^{2+} (0.1mM) and Zn^{2+} (0.1mM), respectively. The reacted solids were characterized using XRD, XAS and TEM. Results indicate that feitknechtite (b-$Mn^{III}OOH$) was the predominant mineral phase formed in the presence of Na^+, Ca^{2+} and Ni^{2+}, whereas hetaerolite ($ZnMn^{III}{}_2O_4$) is the product in the presence of Zn^{2+}. The four types of cations exhibit different inhibitory effects on the reaction rate in the increasing order of Na^+, Ca^{2+}, Zn^{2+} and Ni^{2+}. The strong Ni^{2+} inhibitory effect is likely due to its ability to enter vacant sites and/or adsorb on edge sites of d-MnO_2.

Wednesday, August 31, 2011 06:00 PM
Abiotic and Biotic Interactions at Nano-Scale Interfaces (06:00 PM - 08:00 PM)
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