Supplementary Information

Potentiometric and electrophoretic insights into malonate interactions with hematite

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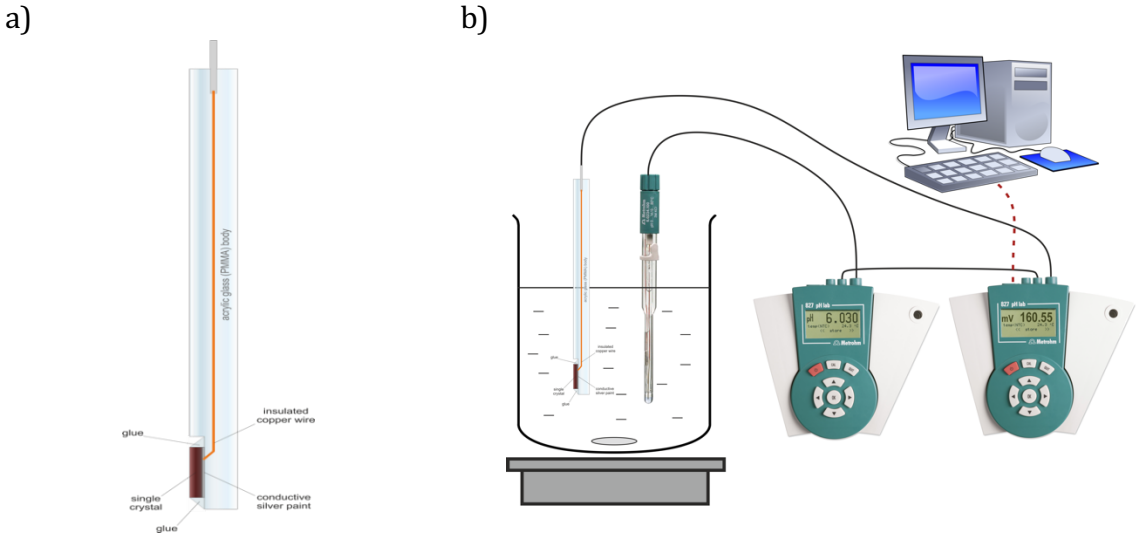

Figure S1. Schematic presentation of hematite (001) single crystal electrode (SCrE), (a) and a cell composed of hematite and reference electrodes for surface potential response monitoring (b).

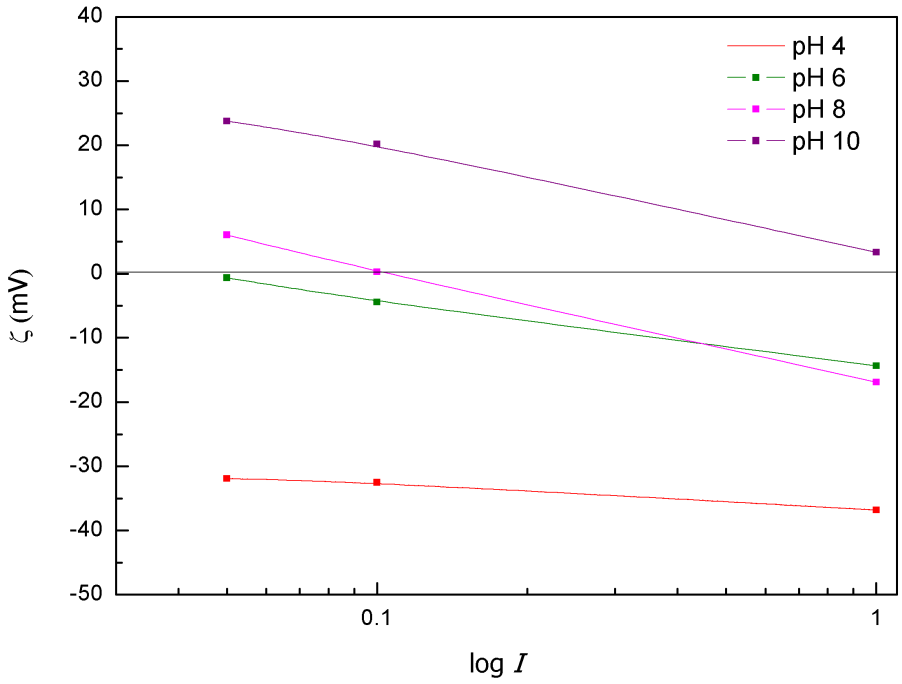

Figure S2. Electrokinetic potential of hematite suspension as a function of ionic strength of NaCl/MA electrolyte.

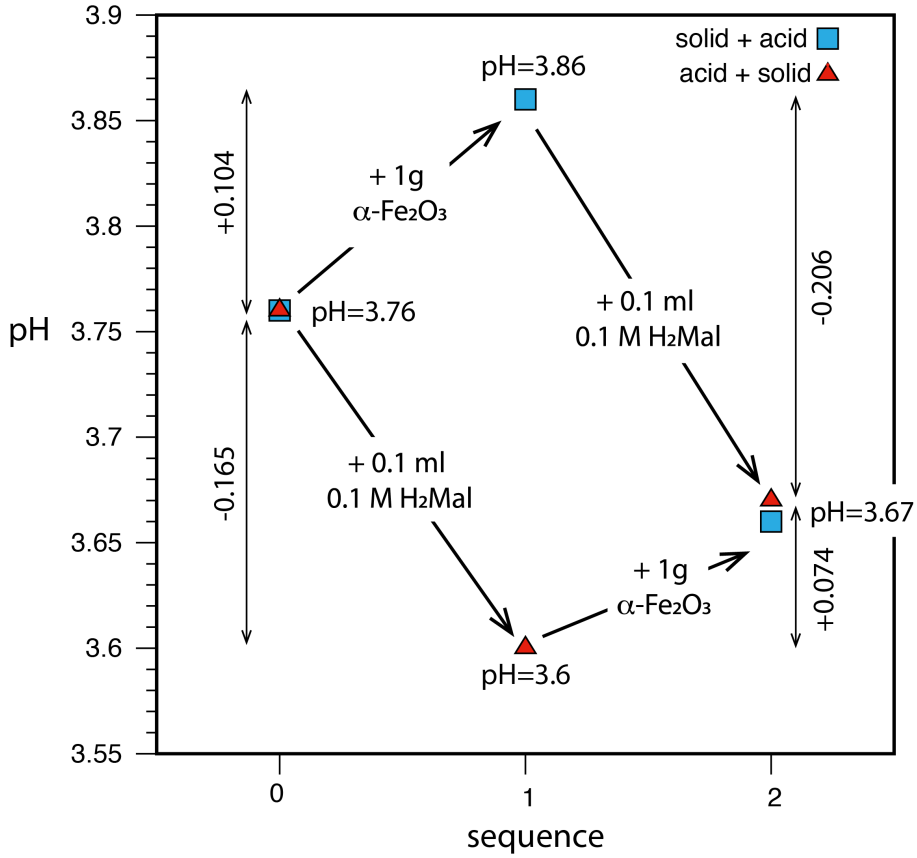

Figure S3. pH changes response in two sequences of additions of malonates and hematite.

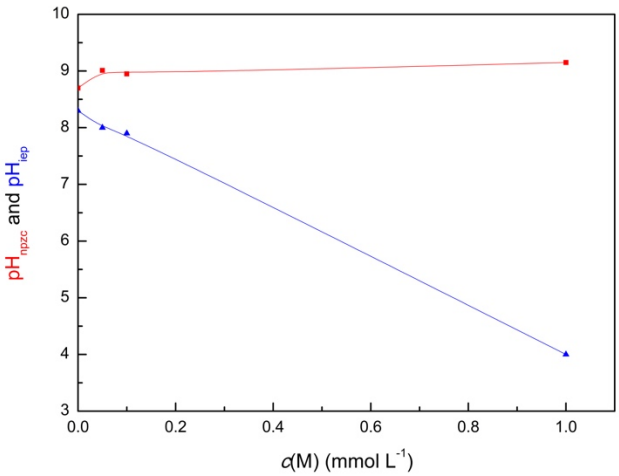

Figure S4. Effect of malonate ions concentration on pH_{npzc} and pH_{iep} of hematite.

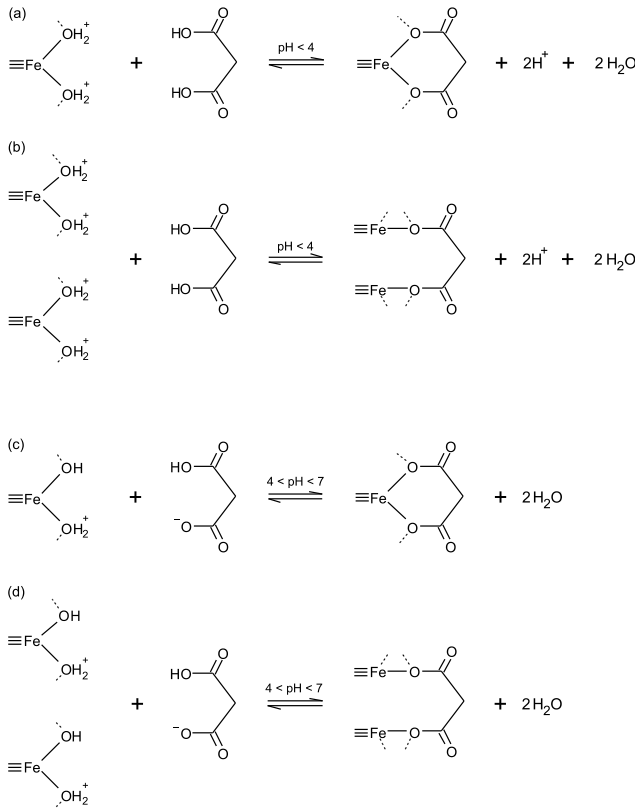

Figure S5. Proposed reactions of adsorption of malonic acid and malonate to the hematite (001) surface for two types of bonding, bidentate mononuclear (a), (c), and bidentate binuclear (b), (d) at pH lower than 4 (a), (b), and for pH between 4 and 7 (c), (d). The dotted lines represent a continuation of bridging oxygen bonds across the surface. The proposed reactions ((a) and (b)) can explain the observed decreasing surface potential at pH < 4, since these types of surface reactions are crowding out H+ (therefore decreasing surface charge). At higher pH, in the case of $-COO^-$ groups at the pH > 4 ((c) and (d) - malonate anions), the preferred type of association is bidentate dissociated inner sphere complex. This type of binding does not significantly change the surface charge, therefore neither its potential.