

Supplementary Materials

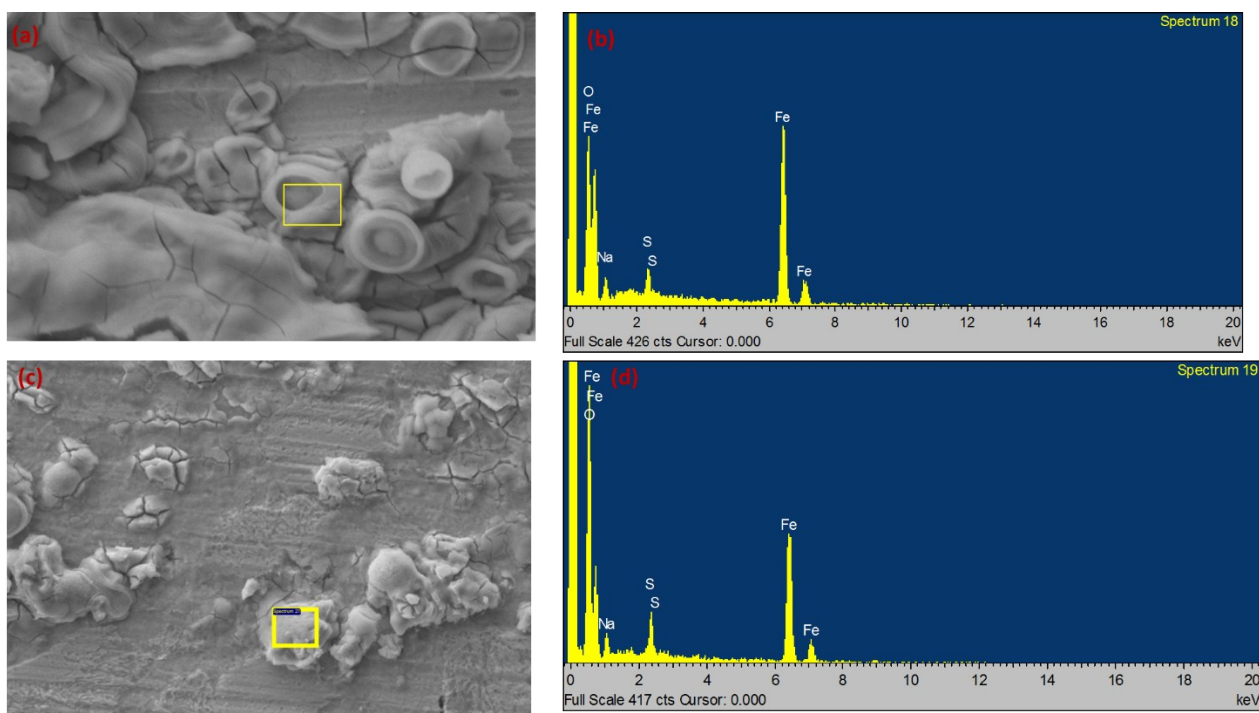


Figure S1. (a) BSE image of film synthesized at 0.1 M sodium thiosulphate in CO₂-saturated brine at room temperature, (b) corresponding EDS spectrum confirming the presence of Na, S and O along with Fe from substrate; (c) BSE image of film synthesized at 0.5 M sodium thiosulphate in CO₂-saturated brine at room temperature (b) corresponding EDS spectrum confirming the presence of Na, S and O along with Fe from substrate, signal of Fe was less than the signal seen in (b), we speculated that this is because of high film thickness.

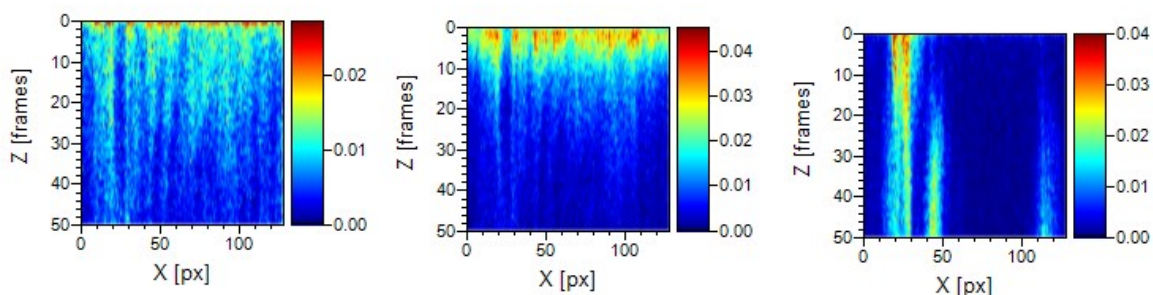


Figure S2. Surface film synthesized at 0.5 M sodium thiosulphate in CO₂-saturated brine at room temperature. Front views of ToF-SIMS depth profiles for O, S and Cl, respectively. Additional data to Fig.10 in the main text.

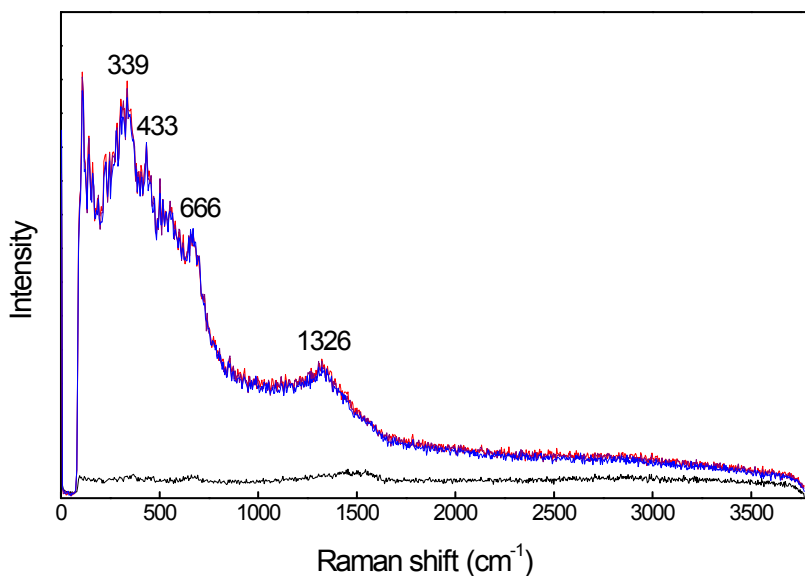


Figure S3. Raman spectra from surface film synthesized with 0.1 M sodium thiosulphate in CO₂-saturated brine at room temperature. The spectra were taken at separate areas across the film-deposited steel substrate.

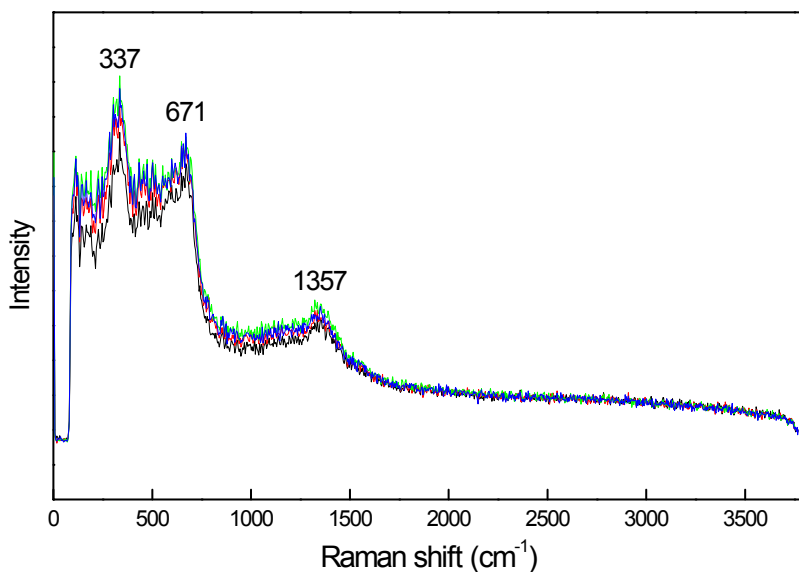


Figure S4. Raman spectra from surface film synthesized with 0.5 M sodium thiosulphate in CO₂-saturated brine at room temperature. The spectra were taken at separate areas across the film-deposited steel substrate.

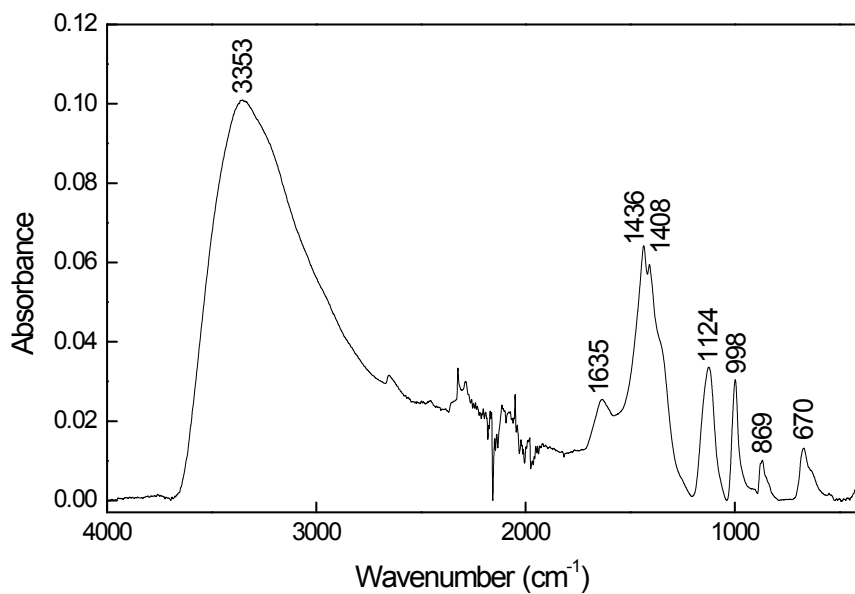


Figure S5. Infrared spectroscopy spectrum from surface film synthesized with 0.1 M sodium thiosulphate in CO₂-saturated brine at room temperature.

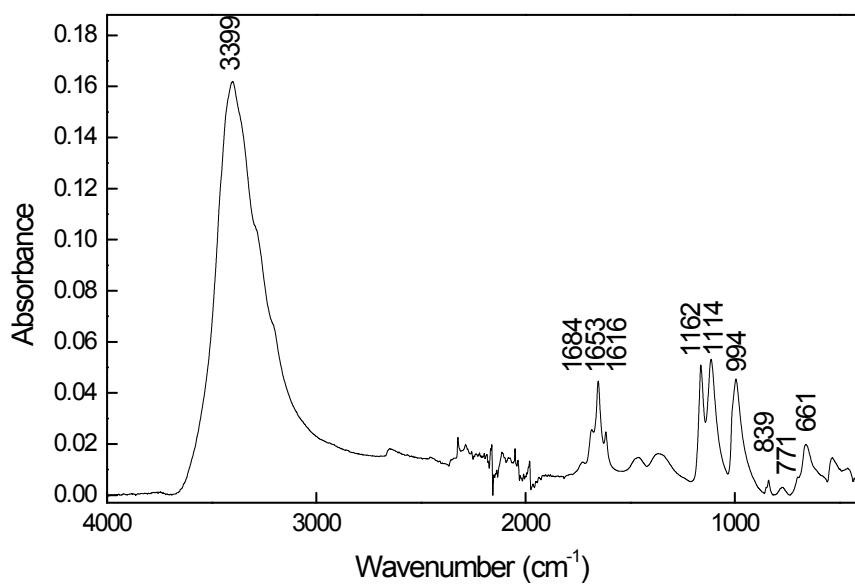


Figure S6. Infrared spectroscopy spectrum from surface film synthesized with 0.5 M sodium thiosulphate in CO₂-saturated brine at room temperature.

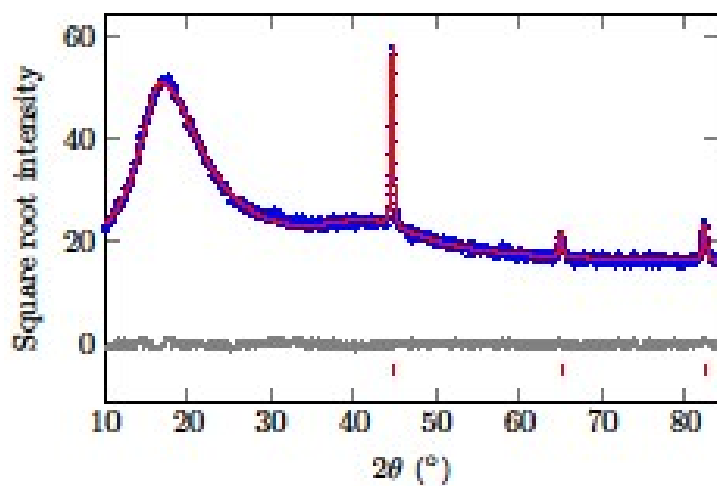


Figure S7. XRD data from surface film synthesized with 0.1 M sodium thiosulphate in CO₂-saturated brine at room temperature. The tick marks indicate the diffraction peaks due to iron.

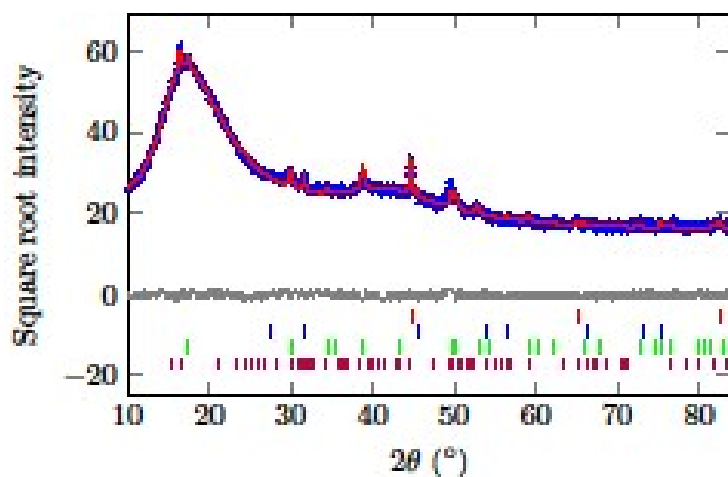


Figure S8. XRD data from surface film synthesized with 0.5 M sodium thiosulphate in CO₂-saturated brine at room temperature. The tick marks indicate the diffraction peaks due to iron (red), NaCl (blue), mackinawite (green), and Na₂S₂O₃ (brown).