



Measuring the Kinetics of Iron-Sulfide Mineral Oxidation Through Dissolution Reaction Systems

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Background & Research

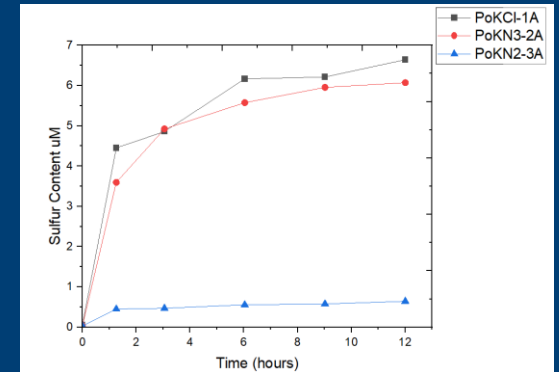


Experiment and Material Prep

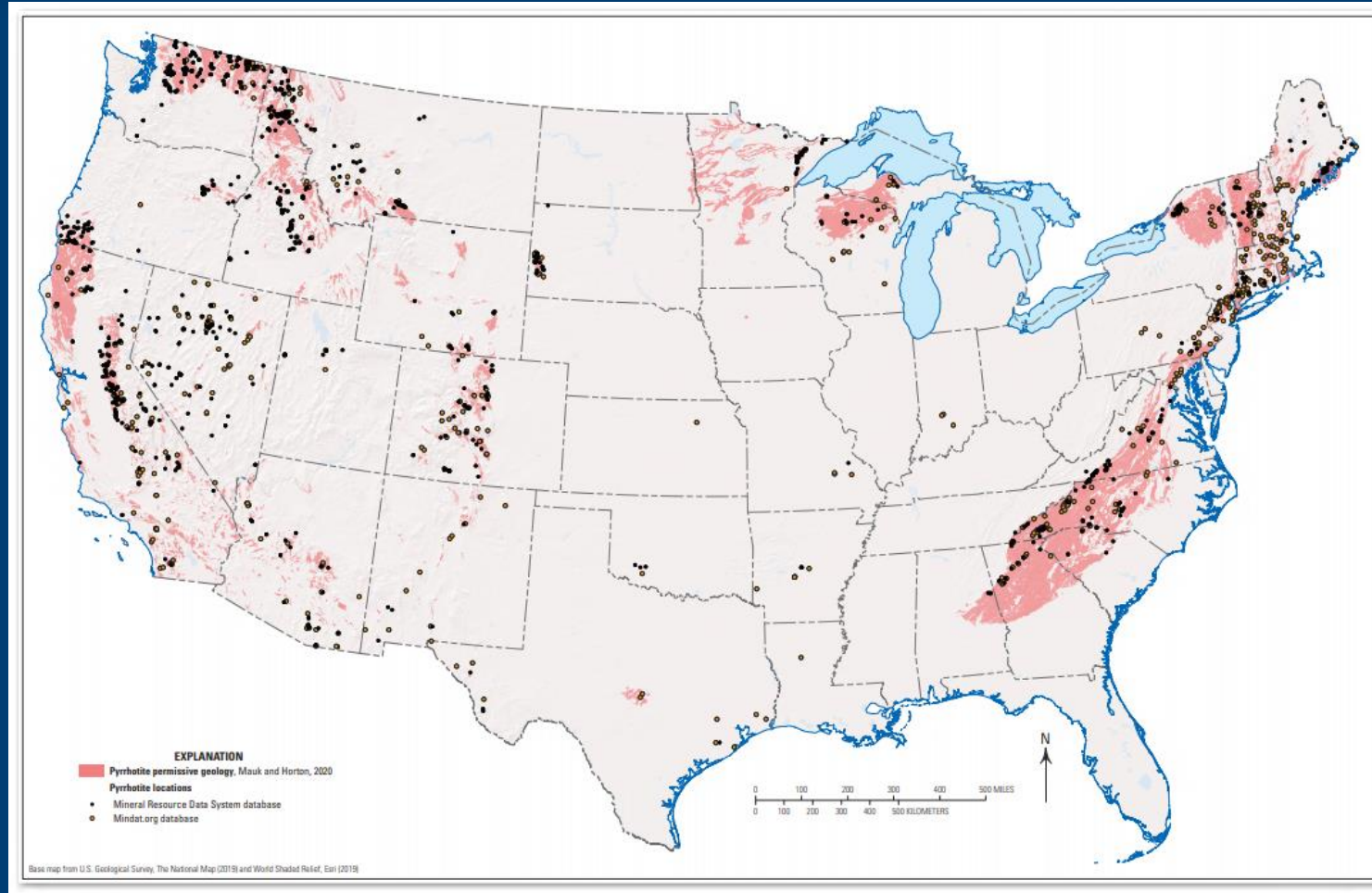
Dissolution Systems



System Results



Aggregates containing pyrite and pyrrhotite used in concrete structures have caused severe damage across the United States.



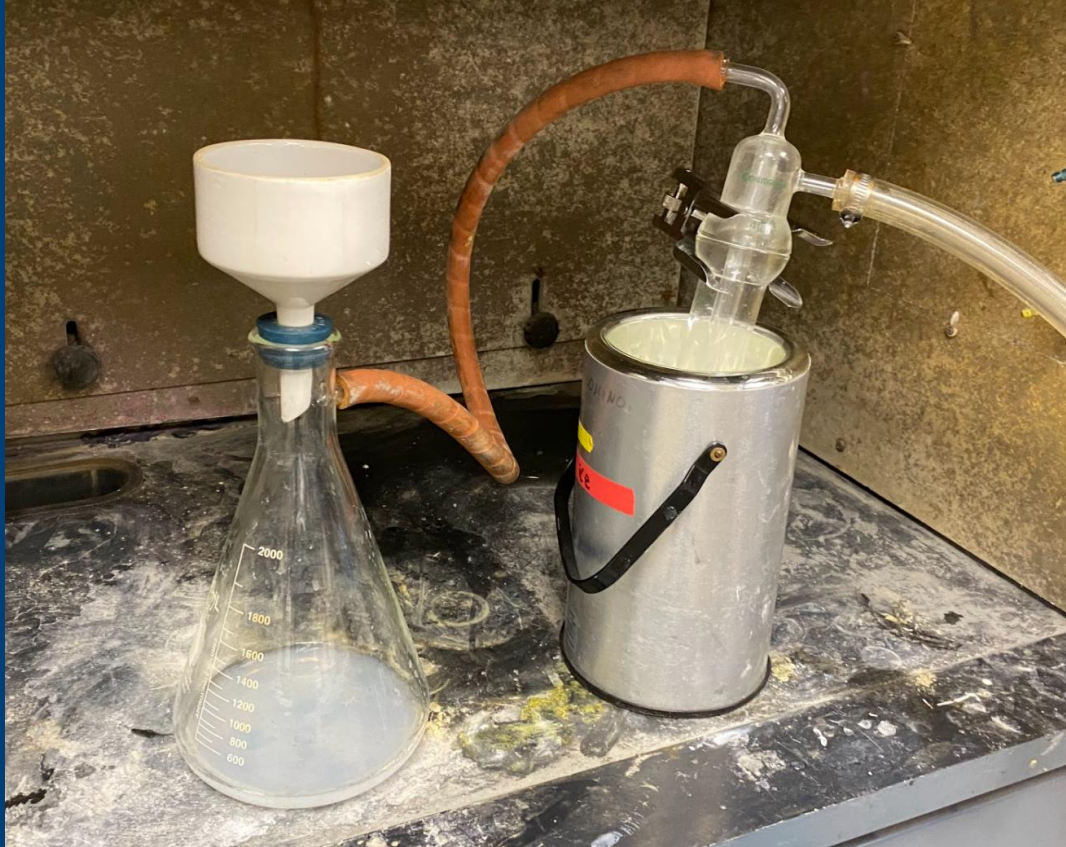
Source: USGS

The mechanisms by which pyrite and pyrrhotite react are not well understood, and preventative measures are not available for mitigation.

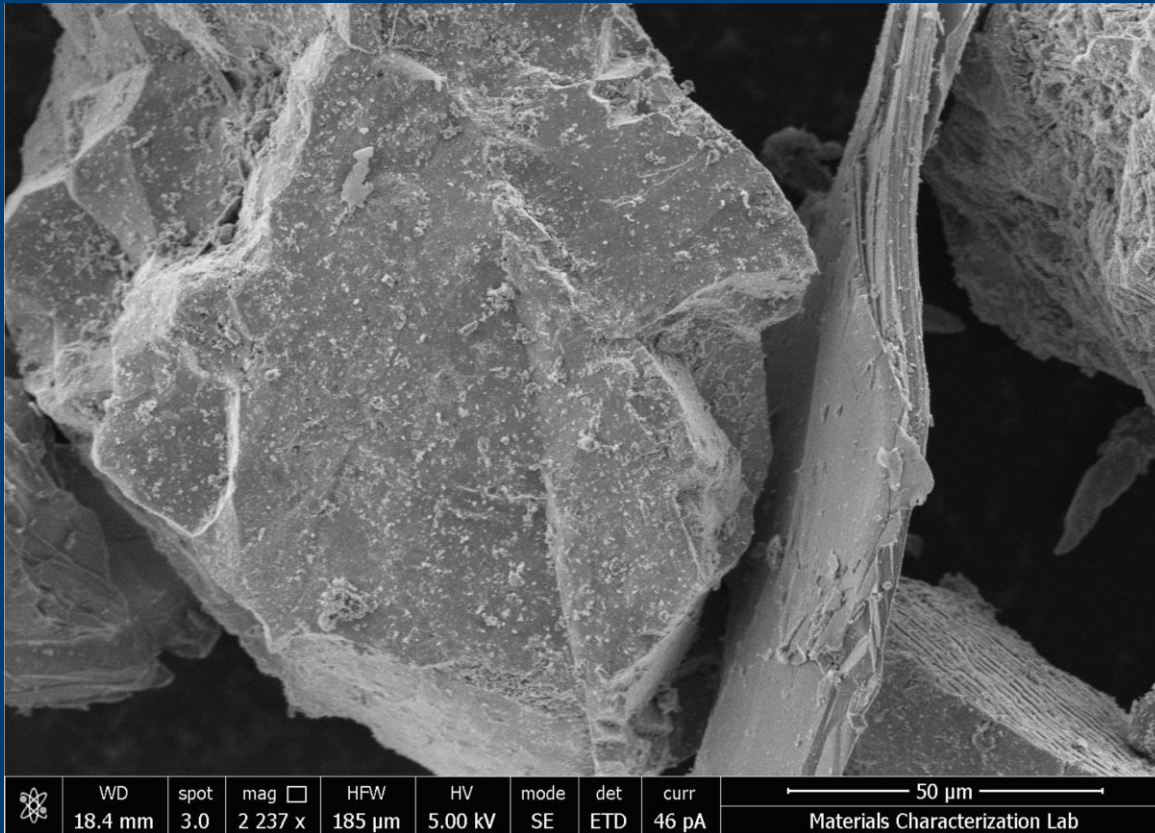


Source: NBC Connecticut

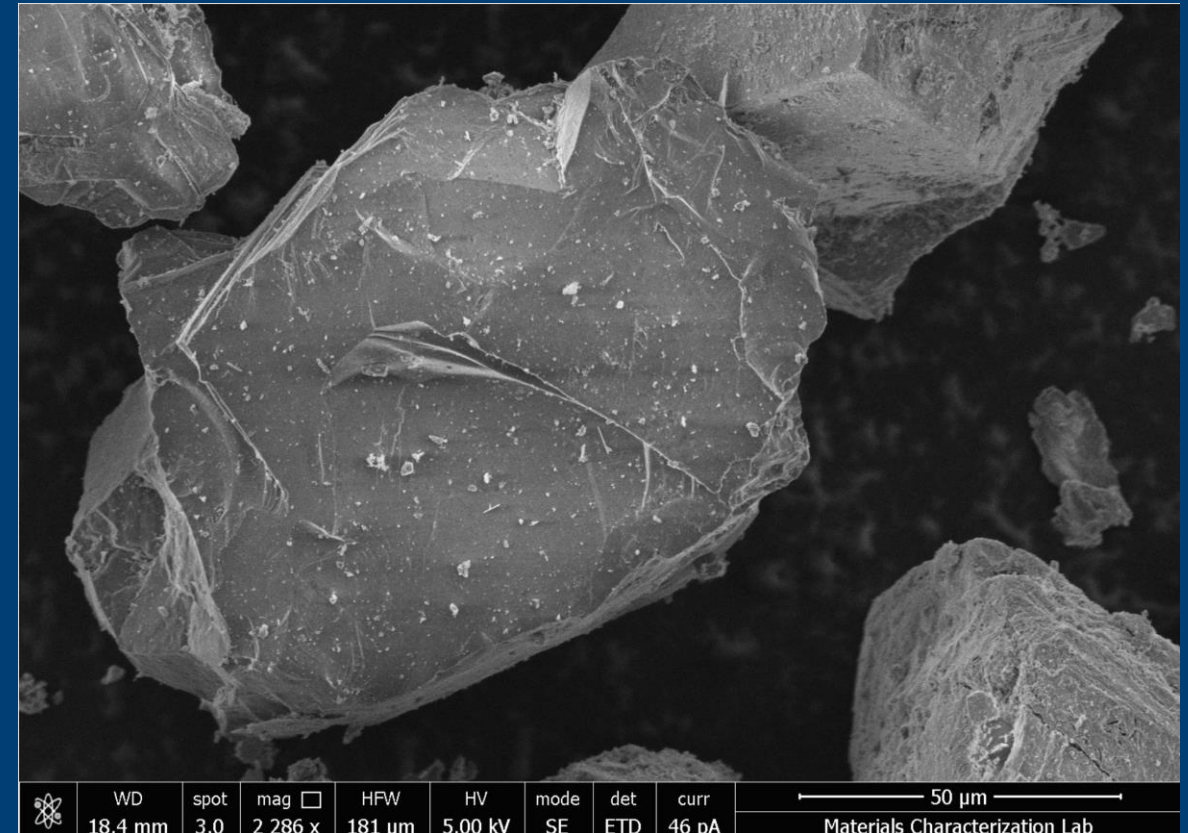
Pyrite and pyrrhotite at three size fractions were ultrasonically cleaned and oven dried to remove existing iron-sulfides on the particle surfaces.



Scanning electron microscopy (SEM) analysis was performed on pyrite and pyrrhotite samples after the cleaning procedure.

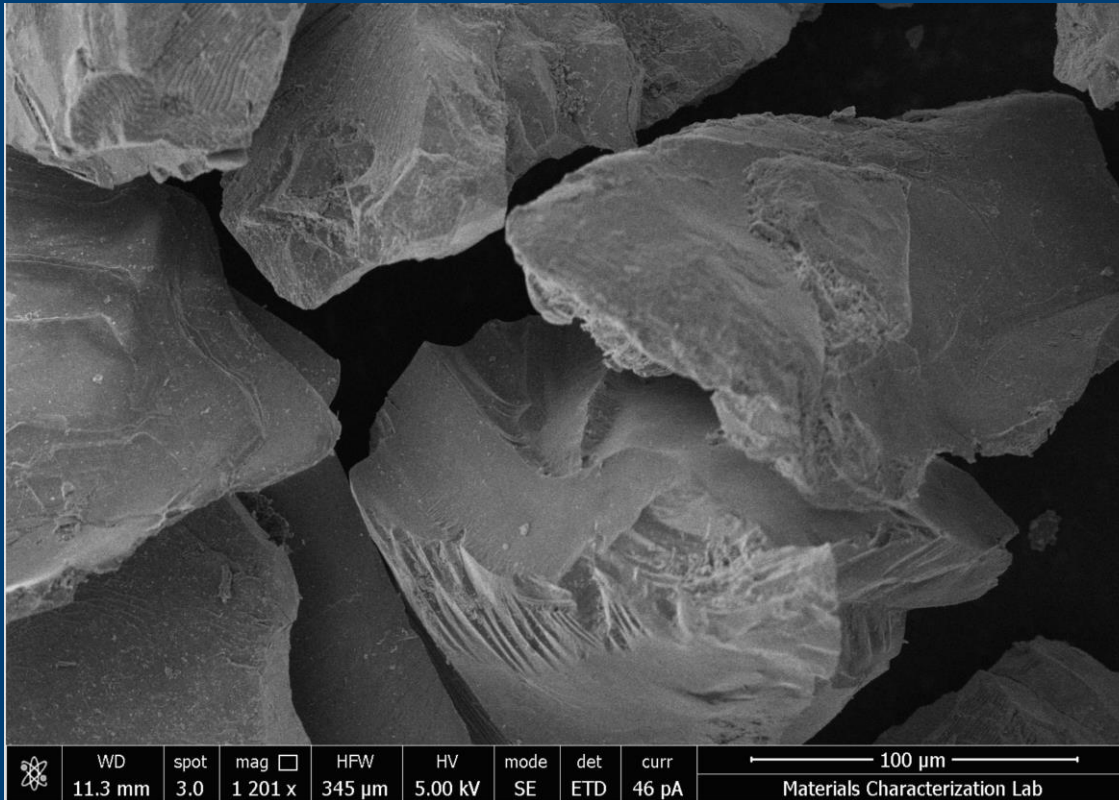


Pyrrhotite Sieve No. 50-100

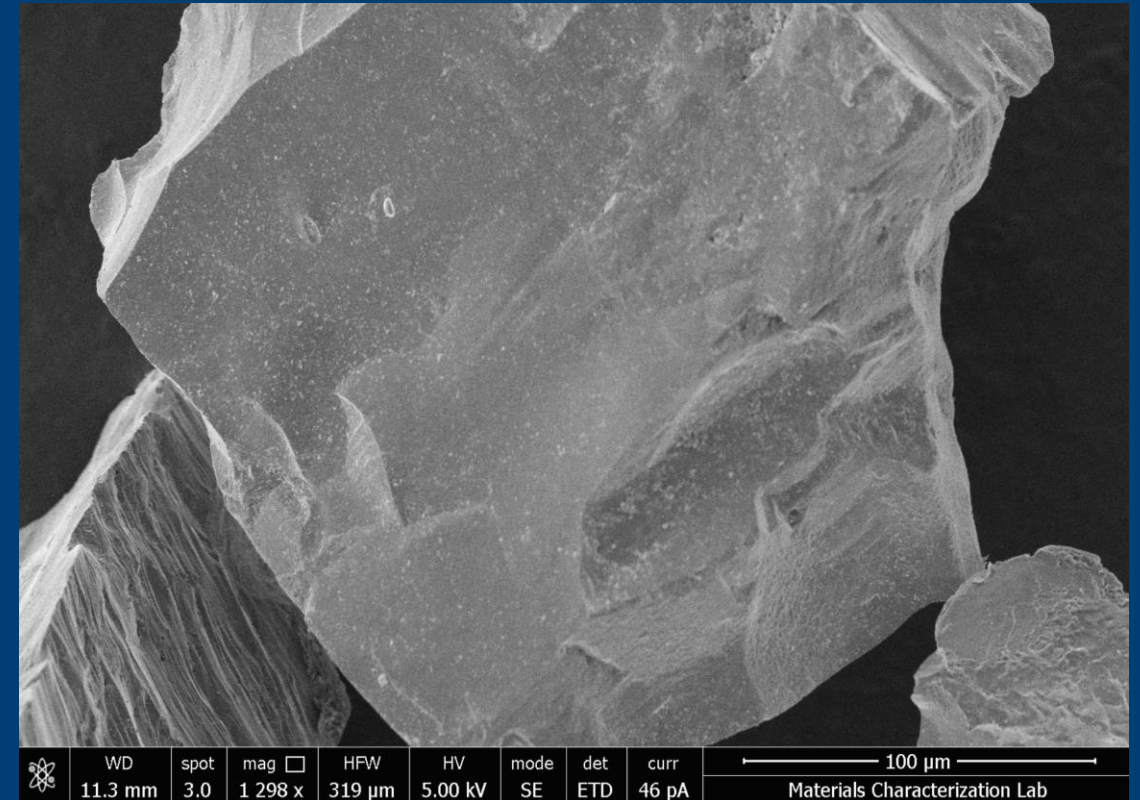


Pyrrhotite Sieve No. 50-100

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Pyrrhotite Sieve No. 50-100

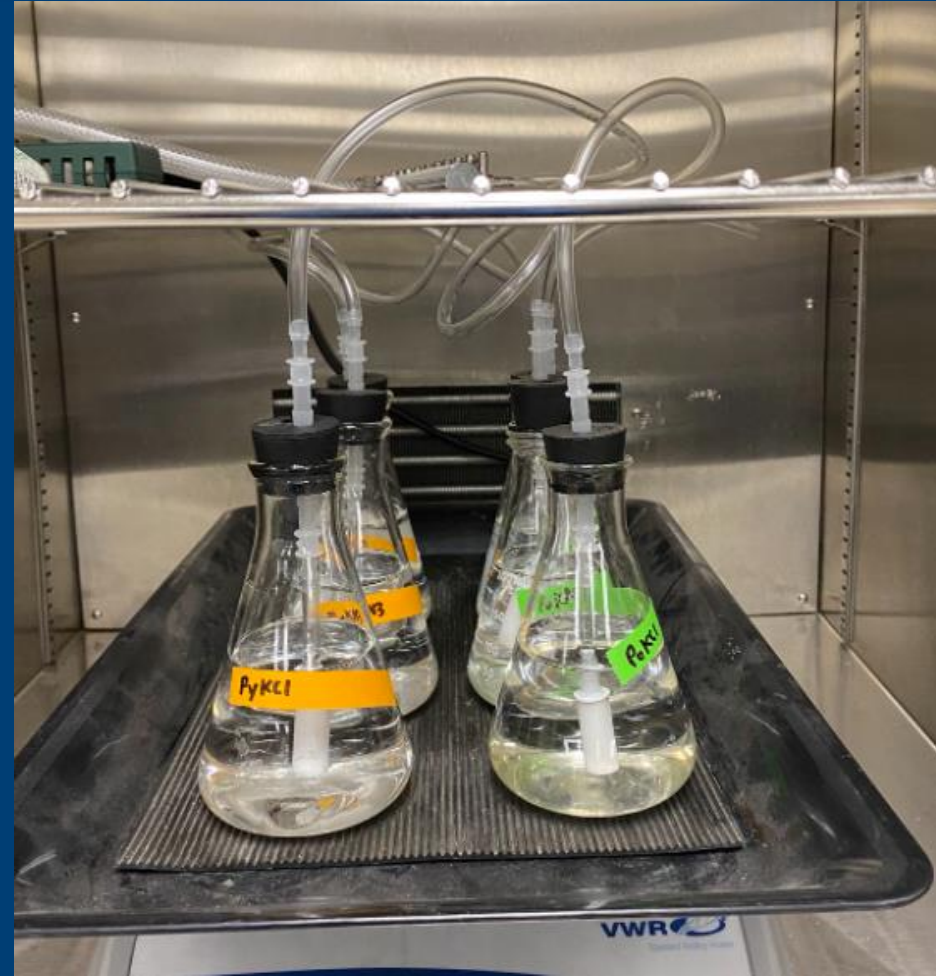


Pyrite Sieve No. 50-100

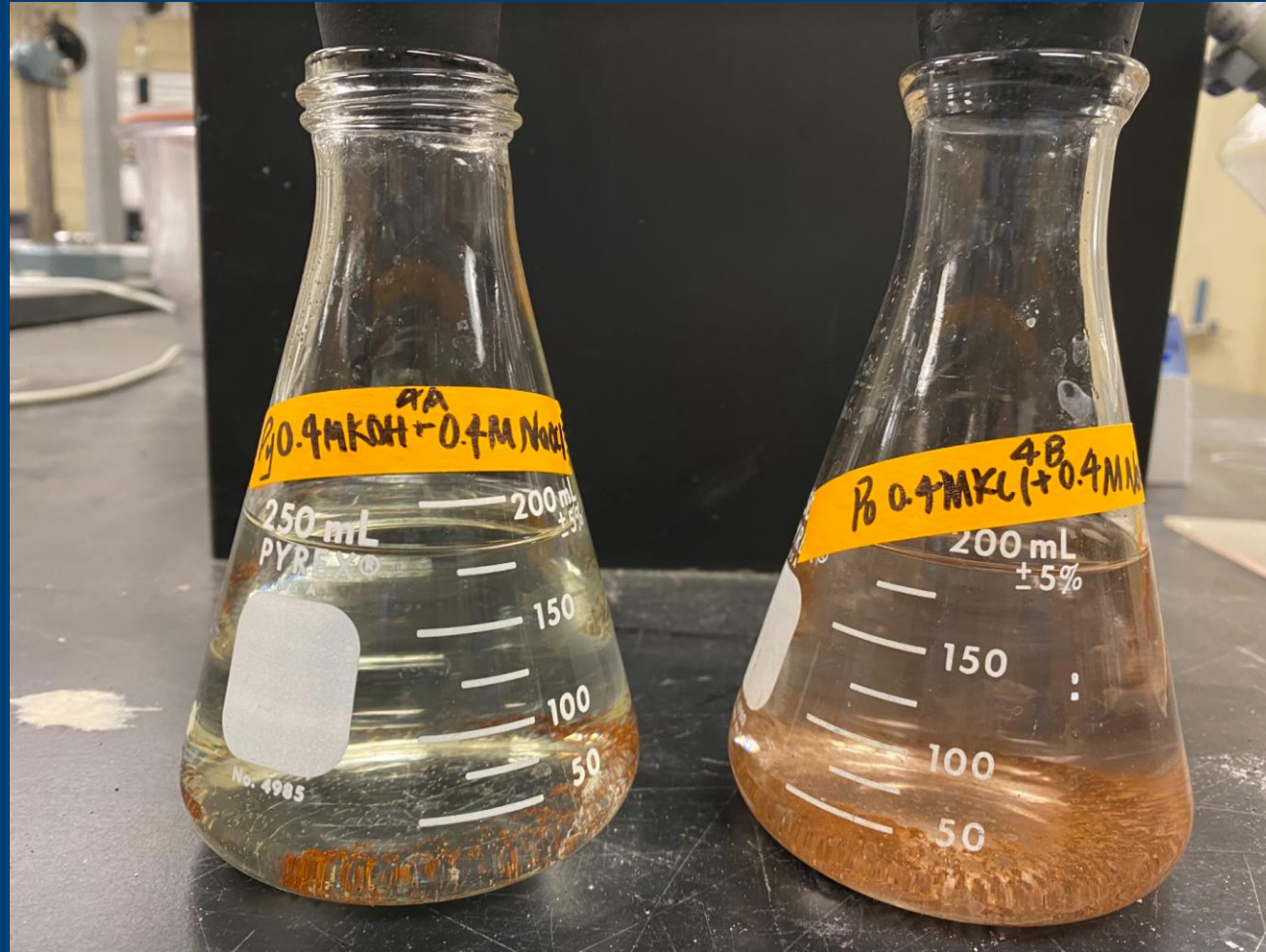
Preliminary dissolution experiments were conducted using potassium chloride, potassium nitrate, and potassium nitrite.



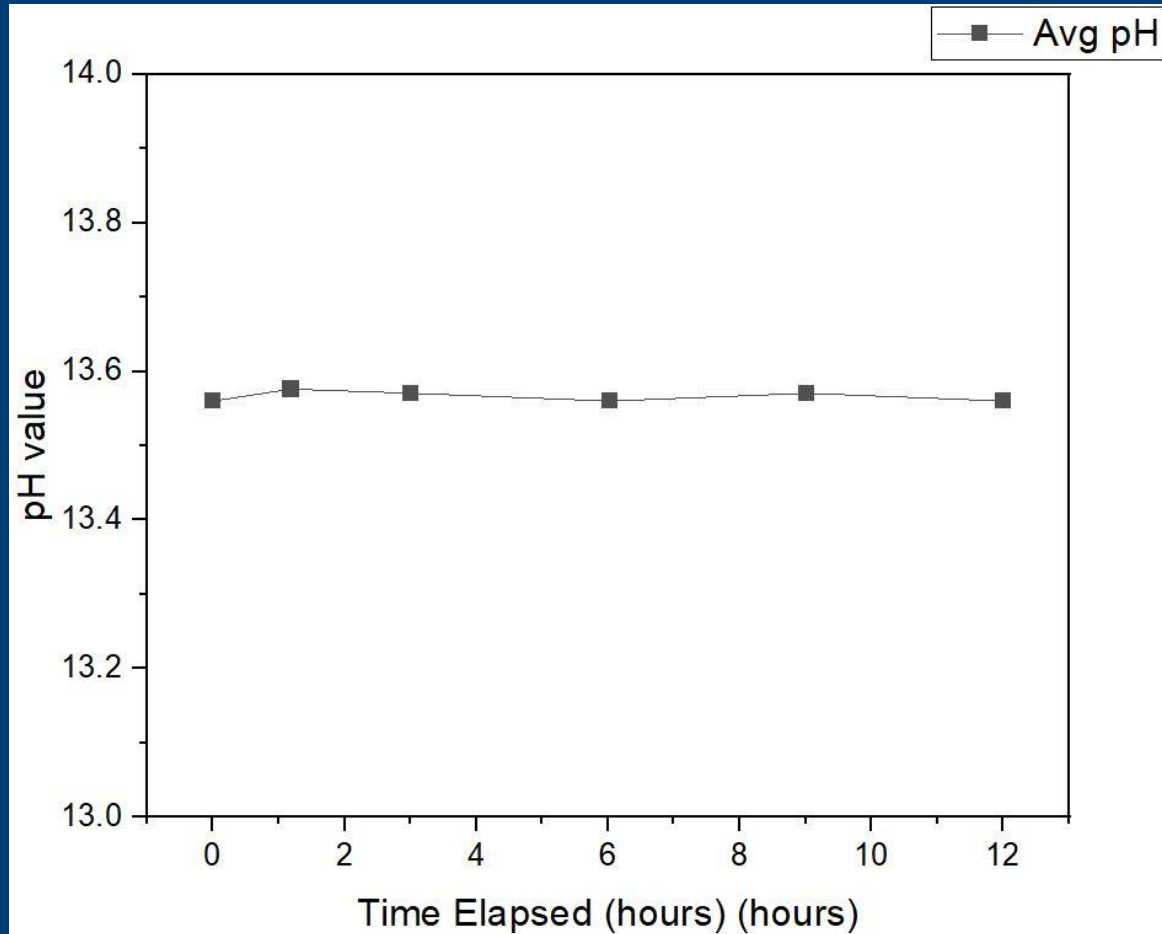
The concentrations of potassium nitrate and potassium nitrite were varied in an additional set of dissolution experiments.



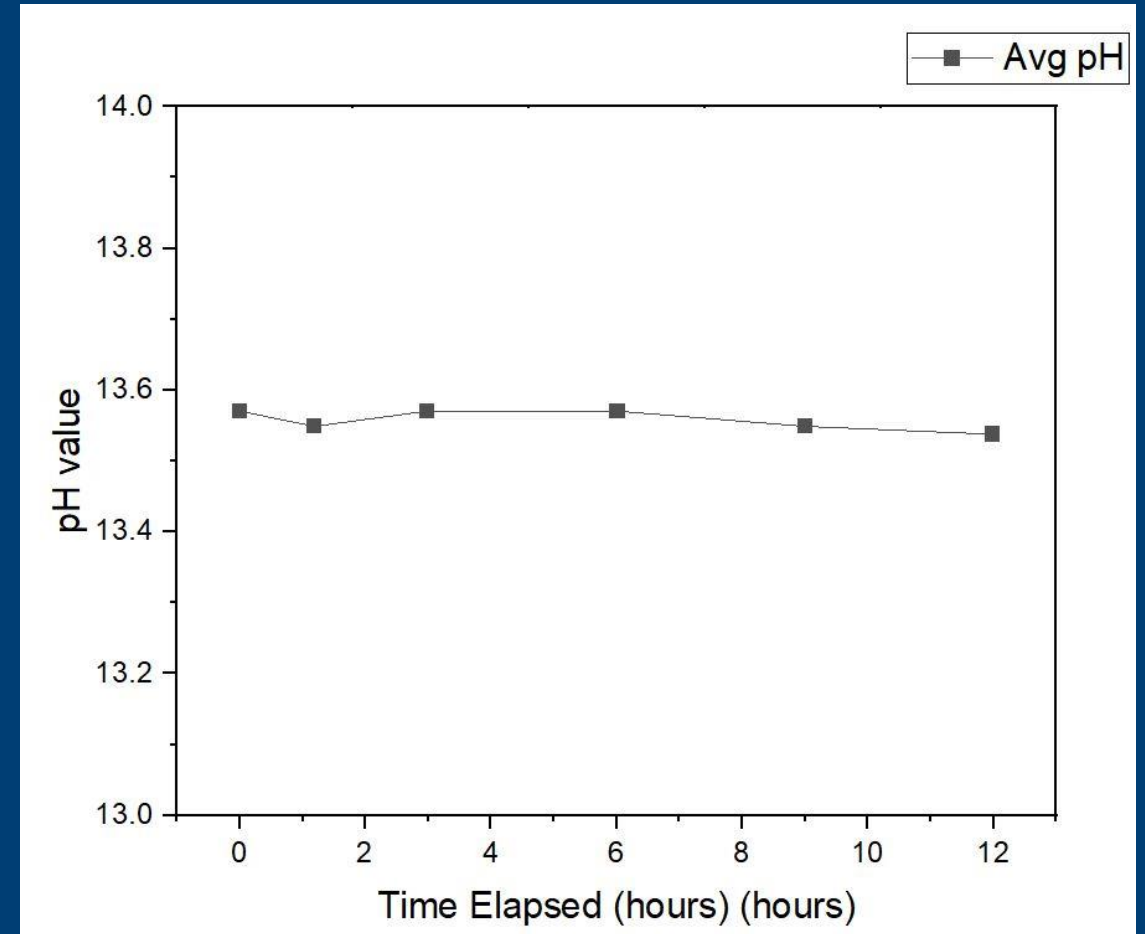
Dissolution experiments with a sodium chloride control, sodium hypochlorite (bleach), and potassium hydroxide were also conducted.



Samples were taken from each flask at hours 0, 1, 3, 6, 9, and 12, and average pH curves were generated based on titration data.



Pyrrhotite and 0.4M KCl



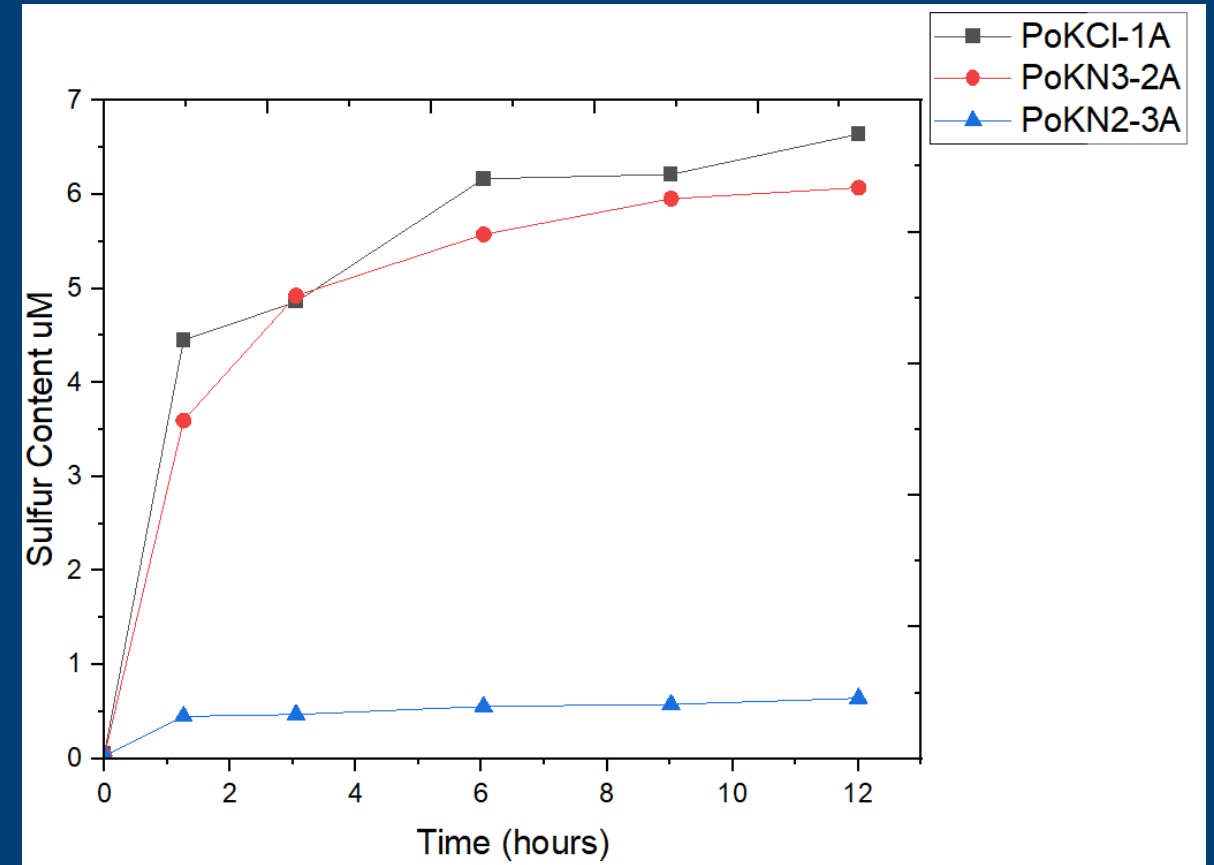
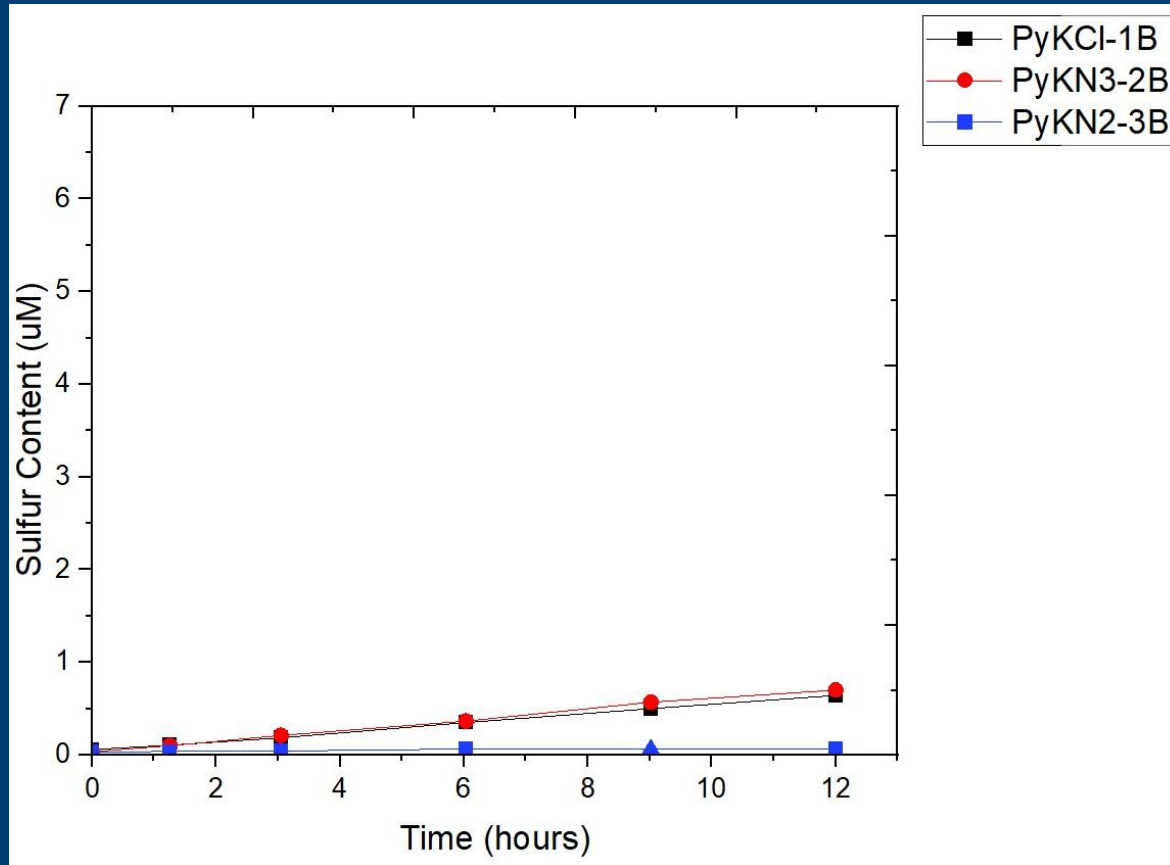
Pyrrhotite and 0.4M KNO3

Sulfur and other ion content over the 12 hour duration were measured using inductively coupled plasma (ICP) mass spectrometry analysis.



Thermo iCAP 7400 -- Source: ThermoFisher

Sulfur concentration was graphed to analyze patterns in dissolution and begin developing rate equations through curve-fitting methods.



Thank you

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