Quantification of Uranium Redox Kinetics due to Interactions with Fe-Bearing Minerals

Y. WEN[1]*, L. SHULLER-NICKLES[2]

[1]Environmental Engineering and Earth Science, Clemson University, 342 Computer Court, Anderson, SC 29625, USA (*correspondence: wen2@clemson.edu)
[2]Environmental Engineering and Earth Science, Clemson University, 342 Computer Court, Anderson, SC 29625, USA(lshulle@clemson.edu)

Fe-oxides have been shown to sorb and reduce uranyl complexes from solution, which plays an important role in controling uranium mobility at contaminated, or potentially contaminated, sites. In this study, uranyl reduction on magnetite was studied to quantify changes to redox rate with respect to the concenration of uranium in solution. Specifically, uranyl redox was evaluated with a magnetite loaded powder-microelectrode (PME) [1] and the redox cycling was quantified using with cyclic voltammetry with modified measurement scheme that enables time-based analysis (Fig. 1).

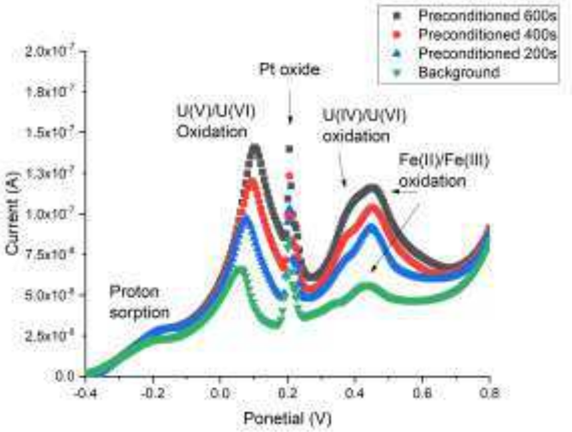

Figure 1: U CV showing progression of oxidation peaks.

Results confirmed that the mineral surface is capable of stabilizing unstable U(V) [2]. Numerical analysis of peak heights reveals that rate constant for each redox pair reduced with increasing uranyl concentration. This suggests that mineral surface can be the limiting factor of U reduction rate at high uranyl concentration with respect to available sorption sites.

[1] Cachet-Viver *et al* (2001) *Electrochimica Acta.*, *47,* 181-189. [2] Roberts *et al* (2017) *Environmental Science & Technology Letters 4* (10), 421-426