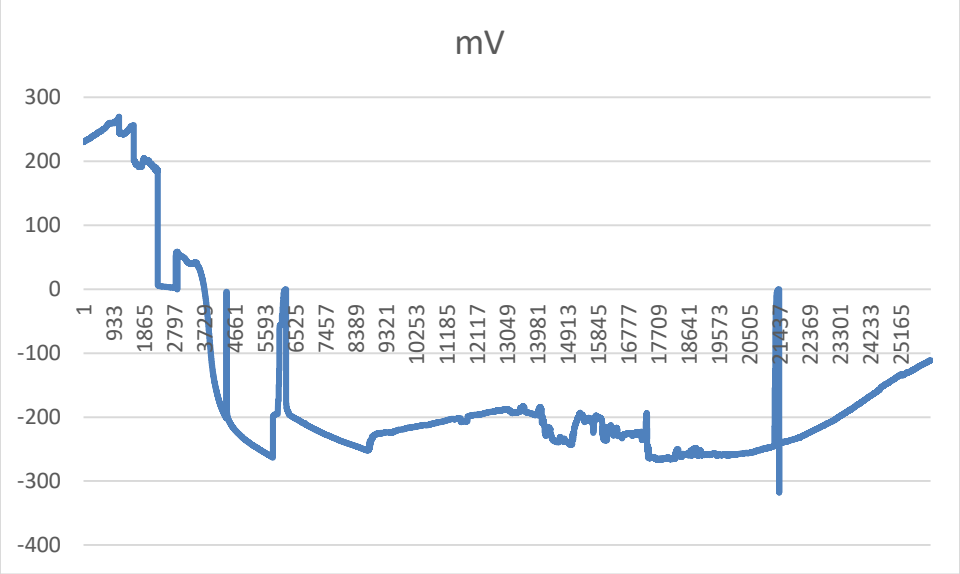
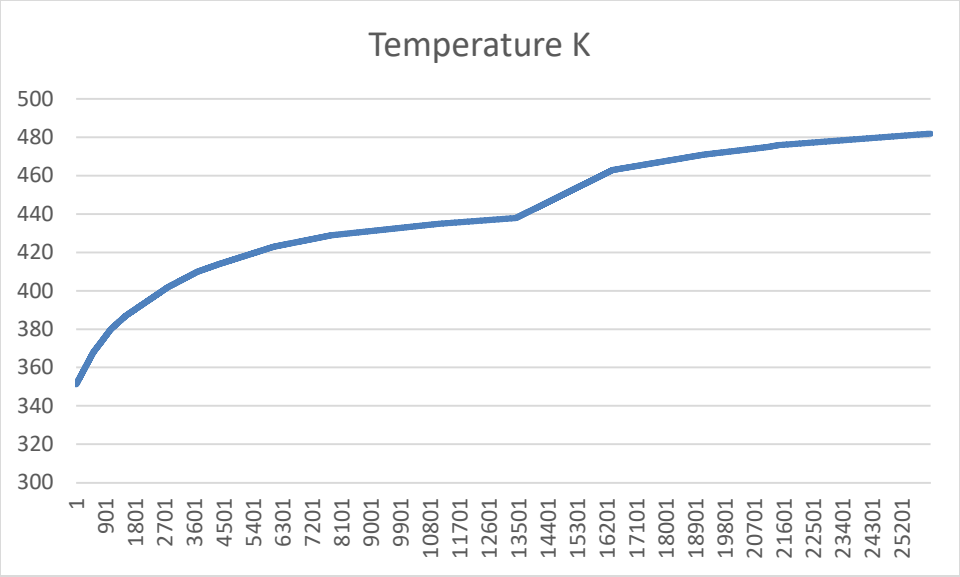
I have observed the FeCl2 plating solution turning an ugly brown during the initial codeposition process when I was using Pt wires as the anode and an iron pipe nipple as the cathode. I tried increasing the current and the solution partially cleared. There was an orange deposit on the glass beaker that was used for the codeposition. The iron pipe nipple ended up with a lumpy black deposit. I inserted it into a galvanized pipe and it produced a voltage and I also conducted a load test from open circuit voltage to as low as I could detect on my DVM which was 0.01 mV.

I then pulled a vacuum and refilled the cell with hydrogen and we placed it in an oven to measure the performance as a function of temperature to over 200 C. The voltage initially increased and then it started dropping and went negative. We conducted load tests when the voltage was positive (WE to CE) and when it was negative. After we stopped recording and turned the heater off in the oven, the cell cooled back to room temperature, the cell stopped producing any voltage. We suspect that we may have lost the hydrogen gas but this is speculation. I still need to do more analysis on the data but I'm including some plots and also some pictures.

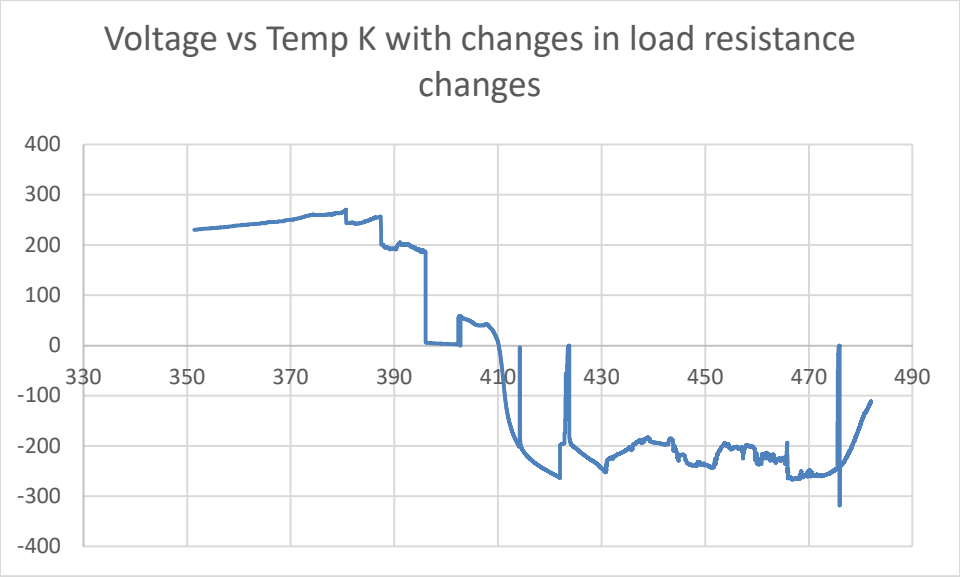
When we initially started the test, we were manually recording the temperature and voltage readings. After about 80 minutes, we connected the DVM to a computer via the optical to USB connection and recorded the data. During the process, we changed the load resistance to try to be operating near what we thought might be the maximum power point of the cell based on previous experiments. THIS IS PRELIMINARY DATA. I STILL NEED TO COMPLETE MORE DATA ANALYSIS WHICH I WILL DO IN THE NEXT COUPLE DAYS AND UPDATE THE PLOTS.



This first plot shows the voltage as a function of time starting when the data was being recorded via the optical link to the computer. One of the things that I need to do is to merge the manual data with this plot.



This plot is the temperature over the same time as the voltage data shown above.



This plot is the voltage vs temperature. Note that the load resistance was changed based on our estimate of load resistance that would produce maximum output cell power. The initial resistance was set to 4.7 k Ω during the manual data and had been reduced to 3.3 k Ω by the time that the computerized recording started. It was later reduced to 1 k Ω. Note that we also conducted several load tests during this time which are the data excursions to zero and then return. I will match up the load resistances with the voltages which will allow me to calculate the current and plot it as a function of temperature. By analyzing the load tests, we will be able to see how close our real time estimates were to the maximum power loads. For now, we can observe that the polarity of the voltage changed and that it supported a load at both polarities. We don't know if this change was caused by the change in temperature and more tests are needed. Note that the voltage started to decline at about 100 C. We

have observed changes in previous tests that occurred at about that temperature, but we don't have enough data to draw any conclusions. There are several possibilities including the temperature that any water vapor in the gas would be converted to steam and/or the changes in the mobility of the ions in the gas which is consistent with the hypothesis that the diffusion term in the conduction equation depends on the difference in the mobilities of the positive and negative ions as pointed out by Darrow. This is preliminary speculation and Harper is reviewing papers on Gerdien Condensers and contact potential batteries by Kramer and Ohmart in conjunction with the work of Darrow on the importance of diffusion. (Of note, people have observed that there is still a current when the voltage goes to zero in a Gerdien Condenser which they compensate for with a bias term. Is this the same effect that Darrow observed in his experiments that we describe in our JCMNS paper??? We suspect that it is.)

I disassembled the cell after test and observed interesting features on the working electrode which are shown in the attached photographs. As I stated earlier, the initial observation was that the Fe was a "lumpy" deposit. After the test, there were multiple features that appeared like small eruptions with a cone shape that were easily visible with the naked eye. No SEM required but it would be nice to have EDX to analyze the materials. I've attached the pictures in a separate format which hopefully will provide the best resolution and you can copy and manipulate them. In the pictures, you can see both the profile view of some of the eruptions and the direct or head-on view of others. The orange/brown color is also observed in the interior of the cone. At this time, we aren't even going to speculate as to what happened to produce the features but would welcome comments.