

**CHEG 3128 – Chemical Engineering Junior Laboratory**  
**Spring 2017 – Battery II Assignment**

Following the laboratory discussion and demonstration period, the team will take the next step in designing their own electrochemical cells. Specifically, the second lecture focused on the fact that electrochemical reactors scale with surface area, not volume. Your team will put this new knowledge to work and use it to build cells that have significantly higher power density than the cells produced in the Battery I assignment.

Using your group's results from the Battery I assignment, choose: one anode material (Al or other you found), one cathode material (Cu or other you found), and one electrolyte (NaCl, bleach or other you found). Be sure in the assignment writeup to state the scientific or engineering relevant reason(s) those cell components were selected – i.e. voltage, achievable current with similar electrode area, safety, availability, etc. Once you have chosen these, you are “locked in” for the remainder of the lab – this way you are comparing “apples to apples” for the assignment objective.

The overall objective of this assignment is to improve your electrochemical cell such that it achieves an output power density (W/L) that is more than **1000 times greater** than your base case from Battery Assignment 1. In order to accomplish this, your team should consider taking two approaches, perhaps even simultaneously:

1. Develop a reliable approach to create a high surface area anode and cathode electrodes;
2. Design the cell packaging in a way that allows for maximum volume of active materials while avoiding shorting the electrodes together (hint: you may need to think some about employing some sort of separator).

For the assignment, your team will:

1. Recreate your “base case” – no less than 3 trials to establish the baseline performance with a focus on minimizing the variance between the cells;
2. Demonstrate that your team can design and build at least 3 unique cells with the same chemistry as (1) that achieves 1000 times the power density (W/L) as cell (1)
3. Document your process to achieve the goal – the first cells you build will likely not meet the target. Talk us through your intermediate designs – why do you think these cells were not sufficient and what changes/iterations did you make? In short, talk us through your process!

The due date for the above assignment report is approximately three weeks after the Battery II lecture period. The team will almost certainly need to read outside references to sufficiently understand and discuss the systems above. The team should have no less than 5 references in your writeup and analysis. Also, the team should know that the discussion need not be lengthy; concise and correct is always preferred to long-winded and guessing. Also, please feel free to engage the faculty and TA's with questions or any other needed support!