

Description:

The class will develop a basic understanding of the electrochemical system based on the knowledge of thermodynamics, fluid mechanics, and kinetics. We also go over some common techniques that are often used in electrochemical engineering research such as cyclic voltammetry, chronopotentiostat, and chronoamperometry. This will be a fast paced class.

Teachers:

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Format:

There are 3 classes (1 hour each). The classes will be held on Saturday from 4pm to 5pm. We will take notes using Notability.

Syllabus:

Class 1: Introduction to electrochemical devices (batteries, fuel cell). Relationship between open circuit potential and free energy. What is overpotential? Evaluation of the efficiency of an electrochemical cell (heat engine analysis).

Class 2: Kinetics of electrochemical reaction. Butler Volmer equation for multi-step electrode reactions. What is a Tafel slope? Introduction to Marcus theory. Introduction to metal adsorbate introduction. Explanation for the selectivity of an electrolyzer.

Class 3: Introduction to transport mechanism (migration, diffusion, and convection). Example of Copper electrowinning, what is the concentration profile of copper. Experimental methods (CV -simulation here, CP, CA, rotating disk electrode).

For each class, we will introduce new concepts and related equations. Toy examples will be followed after each concept to illustrate the point. The idea is to get students familiar with concepts in electrochemistry.

We will send a google form at the end of every class for students to report how comfortable they feel with each part of the class.

If you cannot attend a class, we will post the lecture notes after each lecture so that you can review the materials to prepare for the next class.

Resources:

10.626 project video:

https://www.youtube.com/watch?v=RPIflIge_kQ (Can renewables really keep the lights on?)

<https://www.youtube.com/watch?v=xZdkQaeoK4U> (How safe are electric vehicles really??)

<https://www.youtube.com/watch?v=U3h0BCjBnog> (Instantly Charge your Phone! (Not Clickbait))

<https://www.youtube.com/watch?v=4zhTs44vOnc> (An Intro to Carbon Capture and Usage)