Chem 248: Electrochemistry
Department of Chemistry, UC Irvine, Fall 2023

**Instructor**
Professor Shane Ardo (ardo@uci.edu)
Office Hours: Mon. @ 8 – 9 am, and 5 – 6 pm (via Zoom: no sessions on M11/13, M12/4)

**Meeting Times**
- **Lecture:** T/Th @ 8 – 9:20 am in PSCB 240 (no class on T11/14, Th11/23 (holiday); Zoom link should be used when feeling ill; video-recorded lectures available)
- Final Exam Period is Tues. 12/12 @ 8 – 10 am (Presentations occur during this time)
- "Discussion" (8): Mon. @ 1 – 2:50 pm or 3 – 4:50 pm in RH 453 (no class on M11/13; Zoom on M12/4)
- **Presentations:** Last three meeting periods (T12/5, Th12/7, T12/12)

**Course Objectives**
- To understand and explain the theory behind fundamental electrochemical processes
- To be able to design, perform, troubleshoot, and analyze electroanalytical experiments and data
- To quantitatively and qualitatively assess problems, and empirical data from the peer-reviewed literature
- To summarize and explain seminal and recent electrochemical peer-reviewed literature and technologies

**Required Resources**
  - ISBN: 978-0-471-04372-0; Chapters Covered: A: 1, 15, 4, 5; B: 2, 13, 3, 6; Extra: 12, 9, 10, 16, 17, 18
- Peer-Reviewed Journal Articles and Additional Problems (http://www.chem.uci.edu/~ardo/chem.html)
- Bio-Logic Potentiostat Software for PC (https://www.biologic.net/support-software/ec-lab-software/)

**Topics Covered (tentative)**
- **A1,15** Review+ (Nomenclature, Balancing equations, Electrodes, Potentiostats, Diagrams)
- **A4,5** Mass Transfer (Nernst–Planck equation (migration, diffusion, convection), Fick’s laws of diffusion, Cottrell equation, Anson plot, Ultramicroelectrode (UME))
- **B2** Thermodynamics (Electrochemical potential, Nernst equation, Underpotential deposition (UPD), Liquid-junction potential, Donnan potential, pH probe, Ion-selective electrodes (ISEs))
- **B13** Charged Interfaces (Ionic activity, Diffuse double layer and models, Boundary layer)
- **B3,6** Electron Transfer Kinetics (Marcus–Gerischer theory, Butler–Volmer equation, Tafel equation, Catalysis and volcano plots, Cyclic voltammograms, Randles–Sevcik equation, Corrosion)
- **Extra** Methods (Potential/Current step/sweep/pulse, Hydrodynamic RDE, Impedance spectroscopy, Scanning probe electrochemistry, Spectro-/Photo-electrochemistry)

**Grading (10% of lowest score will be dropped, leaving 90% for course grade determination)**
- **50%** Asynchronous Assignments (8): "Lab activity" write-up and several related problems due one week after odd-numbered activities (Mondays @ noon: 10/9, 10/23, 11/6, 11/27, and Tues. 12/12 @ 8 a)
- **20%** Asynchronous Exam A (24 hours; available Mon. 11/6 @ 5 pm through Mon. 11/13 @ 11 am)
- **20%** Asynchronous Exam B (24 hours; available Mon. 11/27 @ 5 pm through Mon. 12/4 @ 11 am)
- **10%** Synchronous Presentation (~15 min per student; occurs during the last week of classes (Tues. 12/5 and Thurs. 12/7), and during the final exam period (Tues. 12/12 @ 8 – 10 am))

**Course Policies**
Late assignments and make-up exams are not accepted, although I will regrade exams upon specific request.
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UCI Laptop Requirements for Students: https://www.oit.uci.edu/undergrads/laptop-requirements-students/
UCI Policy on Academic Integrity and Honesty: https://aisc.uci.edu/policies/academic-integrity/
UCI Human Resources Working Well Student Resources: https://hr.uci.edu/partnership/workingwell/