Indian Institute of Technology Bombay
Department of Energy Science and Engineering
Electrochemistry (EN 314)

1. Course Content (Tentative)

1.1. **Introduction:** Electrochemical cells and reactions; Faradaic and Non-Faradaic processes; Metal-Electrolyte Interface: Electrical double layers, Double layer capacitance, Cell resistance; Mass Transfer controlled reactions: steady state and transient response; Semi-Empirical treatment of *Nernstian* reactions

1.2. **Thermodynamics of Electrochemical Reactions:** Gibbs Free energy; electro motive force (emf); Half reactions; Electrodes: cathode, anode and reference; Cell potentials and their formulation

1.3. **Kinetics of Electrochemical Reactions:** Homogenous kinetics; *Arrheneous* equation; *Tafel* equation and plots; Electrode kinetics: *Butler-Volmer* theory; Transfer Coefficient; Mass and Charge transfer

1.4. **Electrochemical Techniques:** Overview of some electrochemical techniques; Potential step methods; Current step methods; Cyclic Voltammetry; Impedance Spectroscopy: *Nyquist* and *Bode* plots

1.5. **Applications:** Electrodeposition: Progressive and Instantaneous nucleation, Growth by diffusional process; Fuel cells: Investigation of Reaction pathways ($4e^-$ and $2e^-$ processes), Thin Electrolyte Layer (TEL) Corrosion in bimetallic/end plates; Hydrogen Storage: Diffusion mechanisms of Hydrogen through metal hydrides

2. Bibliography

2.1. *Electrochemical Methods – Fundamentals and Applications*; A. J. Bard, L. R. Faulkner; John Wiley & Sons, New York, 2nd Ed. (2001)

2.2. *Interfacial Electrochemistry*; W. Schmickler, E. Santos; Springer, Berlin, 2nd Ed. (2010)

2.3. *Modern Electrochemistry*; Volume 2; J. O'M. Bockris, A. K. S. Reddy; Plenum Press, New York, 2nd Ed. (1970)

2.4. *Various Journal Articles* – Will be prescribed appropriately

3. Schedule

Venue: LT 005

Slot 1: Mon: 14:00-15:25 Thu: 14:00-15:25

4. Attendance

Not compulsory; 5% Bonus Marks if >80%

5. Evaluation

Quizzes (4x15% each): 60%

End Semester Exam: 40%

6. Teaching Assistants

Aditya MVVS (174170003); 174170003@iitb.ac.in

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7. Instructor

Sankara Sarma V Tatiparti; Faculty office 6; 6th Floor, New DESE Bldg., sankara@iitb.ac.in; Ph. 7672

8. Office Hours

Thursday 15:30-16:30; Other interactions by prior appointments or phone calls

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