

MatSE 561- Metal Electrode Reactions

Course Outline - Spring 2004

Class (2004) Sources	Topics	
1 (1/13)	Aims; Team project; Research proposal; Double layer (dl); Conditions for E^{eq} , E_{mix} , E_{cor} ; IR & E_{meas} at surfaces & in Recesses,.	MatSE 421 Lectures: Ch I Intro, I-4-4, III-1-3, I-5-2, I- 5-3; B&F 1-27, 375-377, 538-546
2 (1/15)	Team Project: Sensors in concrete	T. Y. Won, PhD & R. Wolfe MS Theses, PSU; B&F 73- 80
3 (1/20 & 1/22)	WE Issues, Crevice corrosion at WE? Galvani potential, ϕ , at interface/dl & cell; ϕ , IR & E in recesses	WE handout 1-11; Ch 1 Intro, I-5-1 to I-5-3; B&F 54- 59
4 (1/27)	IR & composition in localized corrosion; E_{cor} in active region; $i - E$ actual & measured curves, Mixed potential theory (MPT)	Crevice handout 1-6; JES, 150 , K1 (2003), 148 , B313 (2001); II-6, II-7-1
5 (1/29)	IR Correction; Meter & actual rate; Charge conservation; I-E & I- η plots; Circuits; Charge transfer & mass transport controls; Butler- Volmer & Tafel eqs.; Passivity, Nernst Eq.	I-5-2, I-5-3, II-1-4 to II-5-2 of MatSE 421
6 (2/3 & 2/5)	Evaluation of team report	
7 (2/10 & 2/12)	Actively dissolving metals & E_{cor} vs. time, pH & inhibitor action;	E_{cor} pH & inhibitor handouts; I-7-1; II-6, II-7-1;
8 (2/17)	E_{cor} – BTA/Zn system, activation & concentration control, effect of O_2 ;	JES, 150, B176 (2003); II-3- 3, II-4-1, B&F 20-22
9 (2/19)	MPT & recesses, $E_{cor} = E_{cathode}$; R_p issues	Plating & SF, 91 (1), 34 (2004); II-8-1, II-8-2, III-5-1
10 (2/24)	Review	
11 (2/26)	Midterm 1	
12 (3/2)	Closing WE Issues: current distribution, spherical WE, IR polarization; Counter and reference electrode issues.	Shih, JES, 134 (3), 551 (1987); CE & RE handout; B&F 22-26,52,53; J: 97-106

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Teaching Assistants

Last up-date: April 30, 2004.