Anodic and Cathodic Polarization of 1018 Mild Steel and 304 Stainless Steel

MSE 130: Experimental Materials Science and Design

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Scan	Soln	Rate	Dir	A_H (V)	A_{Fe} (V)	j_{corr} (A/mm^2)	$\Delta\phi_{corr}$ (V)
0	H$_2$SO$_4$	1 mV/sec	Asc	8.778e-02	8.903e-02	1.784e-06	-4.794e-01
			Des	9.588e-02	8.833e-02	1.888e-06	-4.843e-01
2	H$_2$SO$_4$	10 mV/sec	Asc	8.341e-02	8.519e-02	1.663e-06	-4.730e-01
			Des	5.730e-02	8.076e-02	3.096e-06	-4.842e-01
4	HCl	1 mV/sec	Asc	7.706e-02	8.553e-02	1.277e-06	-5.022e-01
			Des	9.978e-02	8.326e-02	1.765e-06	-5.090e-01
6	HCl	10 mV/sec	Asc	7.490e-02	9.225e-02	1.469e-06	-4.806e-01
			Des	1.035e-01	8.415e-02	2.140e-06	-5.097e-01

Scan	Soln	Rate	Dir	j_{corr} (A/mm^2)	$\Delta\phi_{corr}$ (V)	$\sigma^2(j_{corr})$	$\sigma^2(\Delta\phi_{corr})$	n
1	H$_2$SO$_4$	1 mV/sec	Asc	1.342e-06	-4.830e-01	6.559e-16	0	338
			Des	1.354e-06	-4.841e-01	3.434e-15	0	421
3	H$_2$SO$_4$	10 mV/sec	Asc	2.058e-06	-4.822e-01	2.552e-15	0	342
			Des	1.941e-06	-4.849e-01	1.070e-14	0	444
5	HCl	1 mV/sec	Asc	1.302e-06	-5.032e-01	4.275e-14	0	353
			Des	1.335e-06	-5.085e-01	2.300e-14	0	442
7	HCl	10 mV/sec	Asc	1.265e-06	-4.879e-01	4.494e-15	0	342
			Des	1.297e-06	-4.937e-01	2.720e-14	0	443

Reaction	ϕ_0 (V)	j_0 (A/mm^2)	A (V)	ρ_{lim} (Ω·mm)
H$^+$ reduction	-3.728e-01	-9.612e-08	-1.138e-01	1.587e+02
Fe oxidation (passivation-limited)	-3.927e-01	7.891e-07	3.505e-03	3.905e+04
Cr$_2$O$_3$ barrier breakdown (asc)	9.688e-01	9.902e-07	3.701e-02	1.968e+03
H$_2$O breakdown (asc)	1.596e+00	1.065e-04	2.025e-01	3.230e-312
unknown reduction reaction	1.500e-01	-5.000e-11	-3.289e-02	2.000e+05
Cr$_2$O$_3$ solution deposition	1.070e+00	-1.812e+169	-9.784e-06	4.502e+06
Cr$_2$O$_3$ barrier breakdown (desc)	9.814e-01	4.565e-07	5.713e-02	1.324e+03
H$_2$O breakdown (desc)	1.599e+00	1.016e-04	1.971e-01	3.765e-06

Reaction	ϕ_{pass} (V)	α_{pass} (V^{-3})	ρ_{pass} (Ω·mm)
Fe oxidation (passivation-limited)	-3.530e-01	4.814e+00	6.966e+06
Cr$_2$O$_3$ barrier breakdown (asc)	1.300e+00	8.971e-03	5.670e+07
unknown reduction reaction	-3.000e-02	1.000e+01	1.000e+07
Cr$_2$O$_3$ barrier breakdown (desc)	1.239e+00	7.470e-03	2.868e+07

Reaction	ϕ_0 (V)	j_0 (A/mm^2)	A (V)	ρ_{lim} (Ω·mm)
H$^+$ reduction	-3.478e-01	-3.793e-07	-1.145e-01	3.210e+02
Fe oxidation (diffusion-limited)	-4.695e-01	1.498e-08	3.570e-02	2.157e+03
Fe oxidation (passivation-limited)	-4.695e-01	1.498e-08	3.570e-02	2.157e+03
Cl$^-$ ion pitting	3.928e-01	8.802e-05	4.837e-02	9.837e+01

Reaction	ϕ_{pass} (V)	α_{pass} (V^{-3})	ρ_{pass} (Ω·mm)
Fe oxidation (passivation-limited)	-1.643e-01	5.187e+03	5.946e+03

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5 Discussion

6 Conclusions

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