

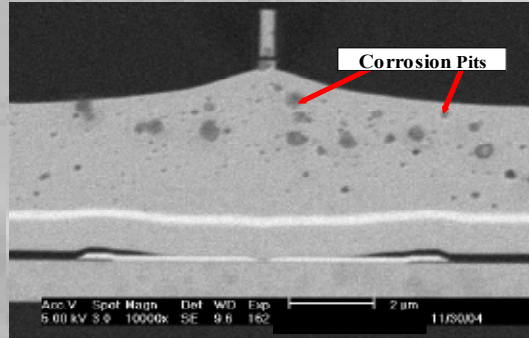
Magnetic Head (Corrosion Inhibitor Additives)

Corrosion Inhibitors

Corrosion inhibitors can be added to the present lapping lubricants, diamond abrasives, cleaning solutions and the D.I. water used for the manufacturing of GMR and TMR magnetic read-write devices. In particular, the corrosion rates of the more reactive metal such as manganese can be reduced by over 90% with the addition of the corrosion inhibitor developed by PACE Technologies (patent pending).

The type and number of metals and alloys being incorporated into the GMR/TMR stack offers

right shows the electrochemical potential for the metals used in the GMR or TMR stack at a metal ion activity or concentration of 10^{-6} M and a pH value of 5.7 (distilled water). The metals with a more



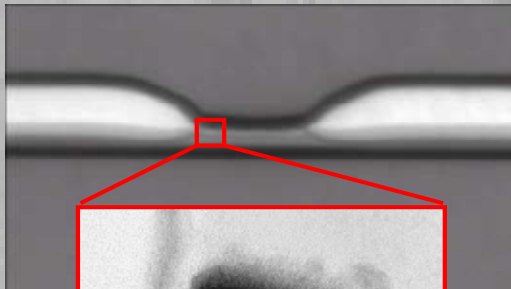
SEM micrograph of Corrosion Pits in the

PCC-5000

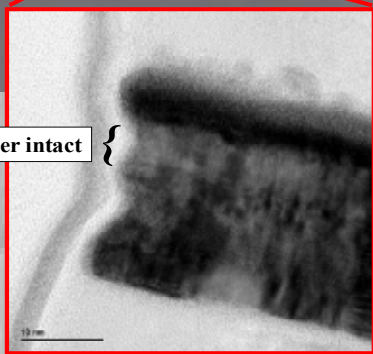
-Propylene glycol lube
-Additive for lapping lubricants

PCC-7500

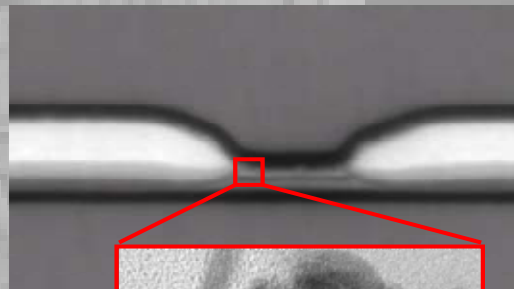
-IPA base
-Additive for cleaning and rinse solutions



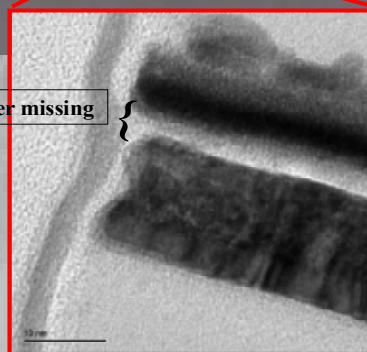
Metal layer intact



TEM micrograph of a good



Metal layer missing



TEM micrograph of a corroded

a plethora of opportunities for galvanic and electrolytic corrosion for the magnetic hard drive and tape read-write heads. Galvanic corrosion occurs when two metals having different reduction potentials contact each other in an aqueous or semi-aqueous solution. The Table to the

negative reduction potential will corrode preferentially to the more noble or higher reduction potential metals when in contact with each other. Galvanic corrosion is also more prevalent as the reduction potential difference between the metals increases.

Corrosion rate reduction with organic inhibitors

	Corrosion without inhibitor (Anstroms/min)	Corrosion rate with inhibitor (Anstroms/min)	Corrosion Rate Reduction
Fe	7.35	0.552	92%
Mn	124	2.05	97%
Co	4.42	0.132	96%
Cu	1.76	0.015	99%
Ni	1.33	0.020	99%

Organic Corrosion Inhibitor Additives

have been demonstrated to significantly reduce the corrosion of the GMR/TMR stack metals. The reduction in corrosion rate using the organic inhibitors specifically developed by Pace Technologies, shows that the corrosion rate can be reduced by >90%.

Inhibitors Additives PG Based Corrosion Inhibitor

– This additive is added to existing lapping lubricants. It is also recommended that the lapping lubricants be used in conjunction with this additive in order to improve the lapping cut rate.

IPA Based Corrosion Inhibitor

– This concentrated additive can be added to most cleaning solutions and especially the distilled water rinse. This inhibitor has been shown to significantly reduce the optical corrosion of the writer head.

Corrosion Inhibitors

Description	Part Number
IPA based corrosion inhibitor concentrate for addition into cleaning/D.I. rinse solutions	PCC-7500
Propylene glycol concentrate for addition into lapping lubricant and diamond slurries	PCC-5000

Reduction Potentials in Distilled Water

Electrode Reaction	Reduction Potential (V) @ 10 ⁻⁶ M / pH 5.7
ZrO ₂ + 4H ⁺ + 2e ⁻ = Zr + 2H ₂ O	-2.10
Mn(+2) + 2e ⁻ = Mn	-1.36
RuO ₂ + 4H ⁺ + 4e ⁻ = Ru + 2H ₂ O	-1.14
Ta ₂ O ₅ + 10H ⁺ + 10e ⁻ = 2Ta + 5H ₂ O	-1.05
Cr(+3) + 3e ⁻ = Cr	-0.858
Fe(+2) + 2e ⁻ = Fe	-0.617
Co(+2) + 2e ⁻ = Co	-0.457
Ni(+2) + 2e ⁻ = Ni	-0.427
Ir ₂ O ₃ + 3H ₂ O + 6e ⁻ = 2Ir + 6OH ⁻	-0.390
Cu(+2) + 2e ⁻ = Cu	0.163
Au(+) + e ⁻ = Au	1.34

More reactive metals (corrode first)

- Potentially can corrode in D.I. water (pH 5.7)
- Forms a non-passive oxide coating

