

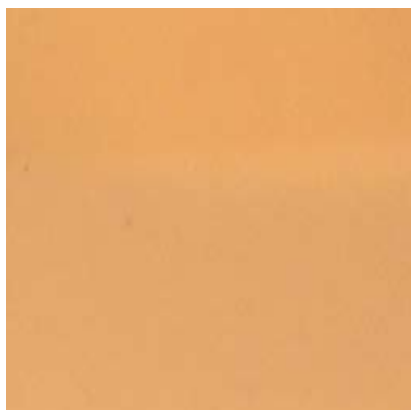


Integrated
Surface
Technologies

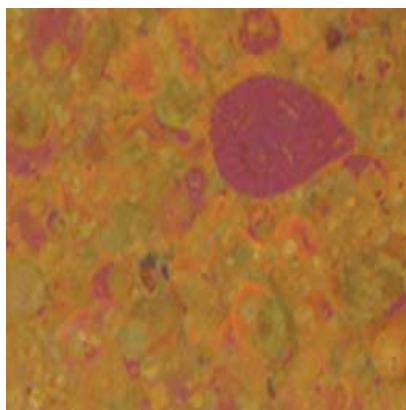
Repellix™ Supermolecular Ceramic Coating Humidity Test

Integrated Surface Technologies™ (IST) provides Repellix™, a supermolecular ceramic coating for water protection of electronics. Like the lotus leaf, Repellix sheds water droplets due to its super-hydrophobic properties. However, as Cheng and Rodak* observed, although lotus leaves are super-hydrophobic as far as droplets of water are concerned, they are actually hydrophilic with respect to condensed water vapor. They observed that the structure of the leaf actually trap humidity vapors inside the tiny hairs, which expel the air and eventually change the surface to hydrophilic. IST has coupled its super-hydrophobic Repellix coating with a vapor corrosion inhibitor (CI) sub-layer to address both vectors: wetting and humidity. In this test, we submit test copper coupons to high humidity environments (85% relative humidity at 85 °C) to test the resultant surface corrosion.

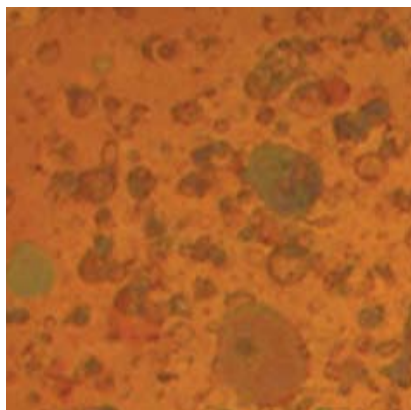
Copper Coupons – Humidity Test



Pre Humidity Test



No Corrosion Inhibitor



Liquid Corrosion Inhibitor



Repellix Vapor Corrosion Inhibitor

In this test, we submitted three trays of coupons into the humidity test chamber at a local test facility. The coupons were obtained from copper wafers, and treated with a variety of corrosion inhibitors. The various corrosion inhibitors tested included an industry standard liquid treatment, a vacuum-vapor treatment, Repellix, Repellix with enhanced durability, and no treatment for the control.

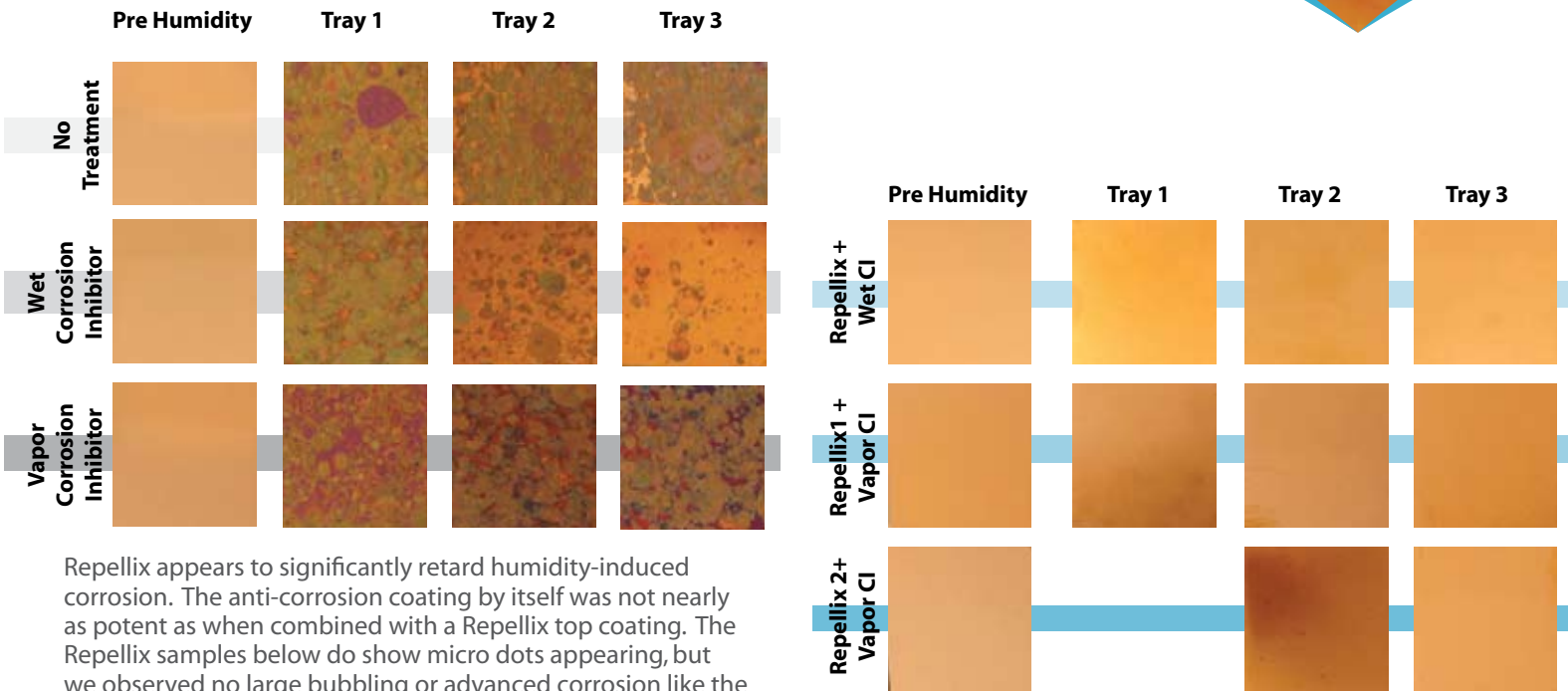
Various combinations will be shown later, but the primary observation is simple–

Repellix provided the only real protection.

On the top left we see the base copper prior to entering the humidity chamber. The upper right sample shows the impact of no corrosion treatment at all. The coupon is heavily corroded. Large areas appear to have been due to water droplets settling on the surface and delving into the copper layers. The lower left picture indicates that the liquid applied corrosion inhibitor also fails to provide long term protection. As water water attaches to the surface, it destroys the thin protective layer and begins its corrosive process. Because it repels water droplets, the Repellix sample (lower right) maintains the safety of its vapor applied corrosion inhibitor layer.

*Y-T Cheng and D Rodak 2005 Appl. Phys. Lett. 86 144101

Visual Results



Repellix appears to significantly retard humidity-induced corrosion. The anti-corrosion coating by itself was not nearly as potent as when combined with a Repellix top coating. The Repellix samples below do show micro dots appearing, but we observed no large bubbling or advanced corrosion like the samples on the left, which did not have Repellix protection.

Microscope Images (10X) Post Humidity



At 10X magnification, we observed significant surface degradation in all cases where the samples did not have a Repellix protective coating. As the above samples show, the industry standard liquid treatment had some minor retardation of the corrosion, but not

nearly as dramatic as a Repellix treatment (right). The Repellix coupons showed significantly reduced corrosion in all cases. Small bubbles of corrosion are only beginning to form in pinholes whereas the other treatments showed advanced damage .