MULTISORB Technologies | *The World Leader in Active Packaging Technology®*

Remediation and Prevention of Moisture in Electronics

Receiving product complaints and returns may be your first indication that there is a problem with moisture in your electronic product. Moisture in sealed electronics may result in shorting, attenuation problems, mirror and lens fogging, intermittent functionality, and catastrophic failure. The experience your customer has with your product directly affects your brand integrity, which in turn affects sales and profits. Taking steps to correct a moisture issue or prevent it early on in the design stages can help you make large strides in reclaiming or protecting your brand position.

Consult with Experienced, Knowledgeable Professionals

To ensure electronic products are protected from moisture, a properly sized desiccant placed within the sealed device will adsorb any residual or ingressed moisture. Since there are many factors to consider when choosing a desiccant, relying on an experienced desiccant manufacturer to assist with the selection can eliminate trial and error and ensure your desiccant is optimized for your device.

At Multisorb Technologies, we consult with each client to gain a complete understanding of their product and its needs. Our experienced engineers will evaluate and test your product for leaks and permeability. Using this data, along with projected service life requirements and specifications, we will make modification suggestions, if needed, or calculate the exact desiccant formulation and form required for your product. Desiccants are available in several forms: tape, packets, pressed forms, or directly imbedded into a component or housing material.

Evaluation and Testing

A water immersion test is typically used to determine if your product is liquid water tight. We use a specially designed immersion tank that utilizes vacuum to determine if an enclosure has leaks. If a leak is detected, there may be a need to redesign or modify the enclosure or select alternate materials as the amount of desiccant that would be required to keep the device dry throughout its service life may be too great for the device to physically accommodate.

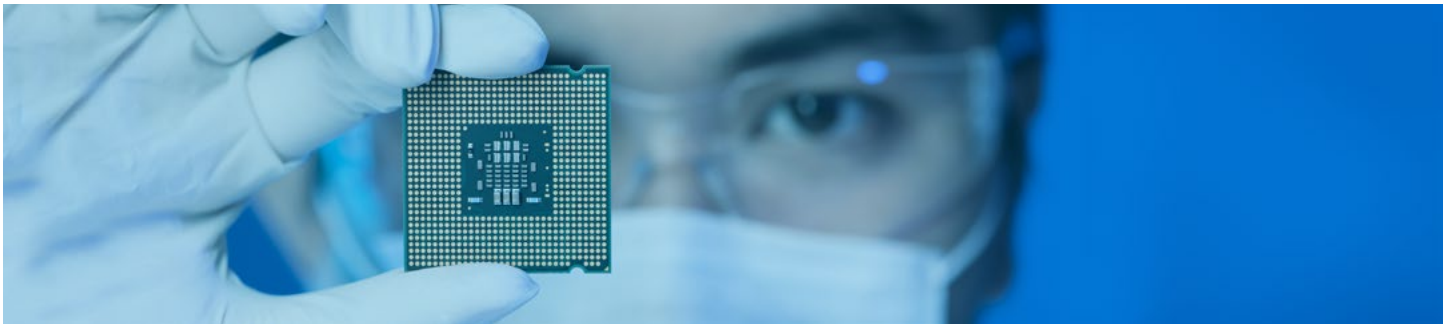
In addition to leaks, many times a major ingress point for moisture is a breather vent. Although breather vents prevent liquid water from getting into the enclosure, they still allow water vapor to enter. This water vapor will condense on internal components inside the device when the temperature in the enclosure decreases either from environmental conditions during shipping and storage or from cycling operating temperatures.

Similarly, condensation can occur from environmental conditions present during the assembly process or from components within the device that may have the ability to contain water vapor. Circuit boards, for example, if not properly dried and stored, can contain significant amounts of moisture from processing. In any application where the enclosure will undergo rapid cooling or very rapid heating (as in oil and gas exploration), the moisture that starts out in the enclosure can result in condensation within the device.

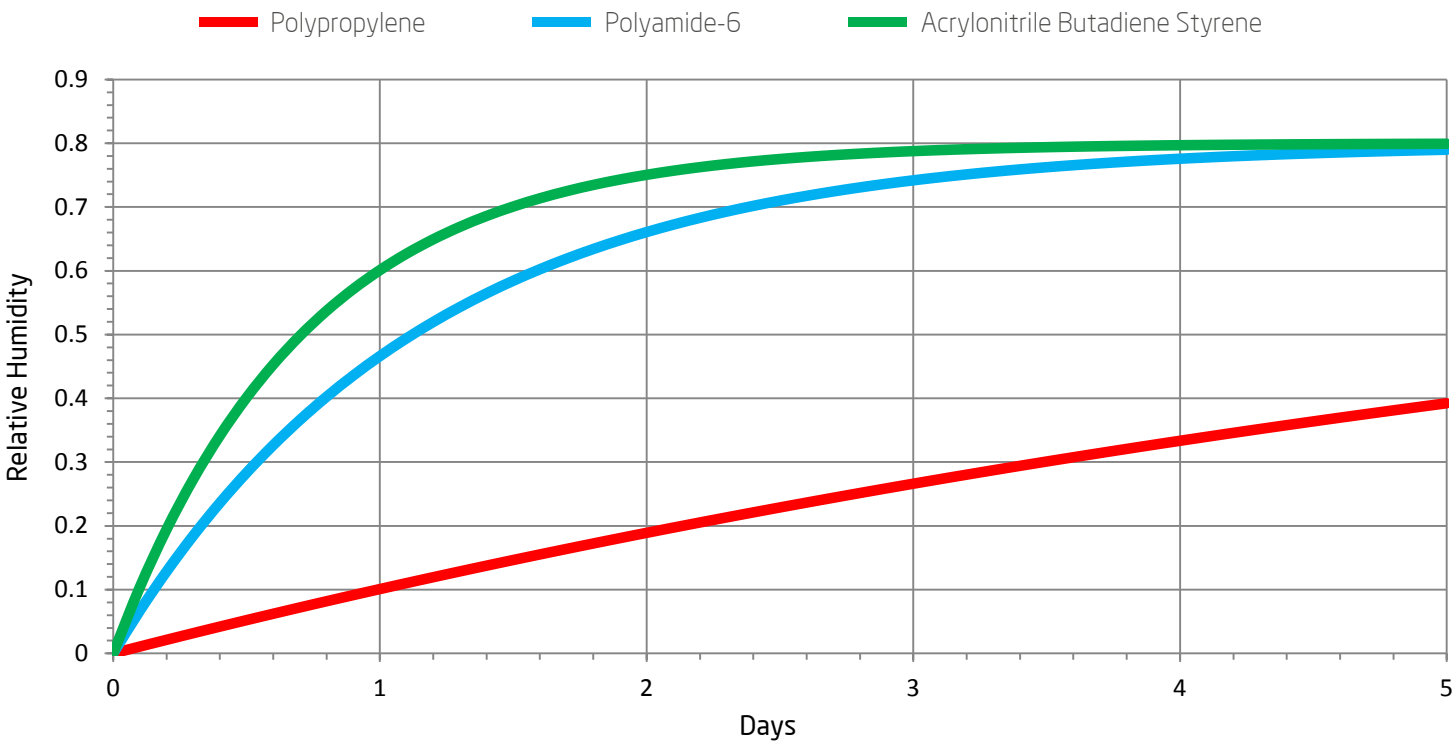
Moisture trapped in the enclosure can be prevented by drying components and boards in a dry cabinet before assembly. Another preventative measure is to purge the enclosure either with dry air or nitrogen to remove moisture from the enclosure atmosphere. Controlling the ambient environment in the manufacturing area can also be a means to decrease humidity in the ambient air during assembly. The most common solution, however, is to include a desiccant that has been sized correctly to adsorb the moisture that has been sealed into the assembly.

Many engineers are surprised to find that enclosures that have water proof ratings, such as IP 68, may still have issues with internal moisture due to ingress of water vapor through the enclosure polymer.

After a leak test is performed, the next step in the evaluation and testing process is to determine experimentally how much moisture enters into the enclosure over time under specified conditions. This moisture may be getting in by permeation or by leakage as discussed previously. If there is measurable leakage, the permeation will be relatively insignificant in comparison; however, without leaks, over the lifetime of the device, moisture ingress can result in significant condensation within the device.

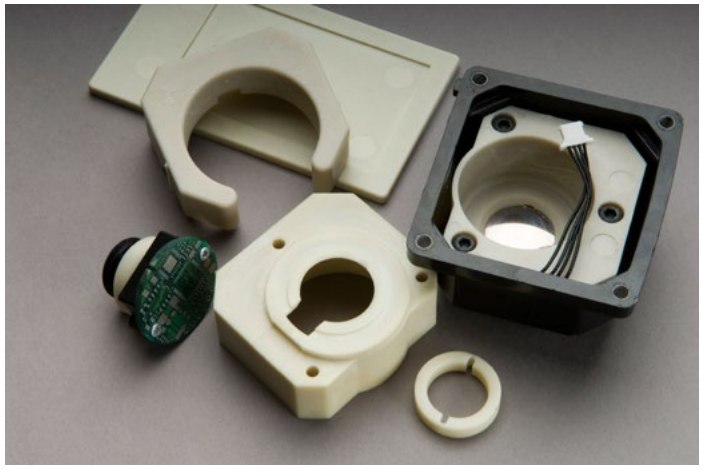


The graph shown below gives a visual indication of an example of the rate ingress of water vapor through the device over time for three different polymers: polypropylene, polyamide-6, and acrylonitrile butadiene styrene. The examples presented here represent enclosures that have 1mm thick walls, headspace volumes of one liter, and surface areas of 600cm2. The testing was done at 40°C/ 80% RH (0% internal RH). This graph clearly demonstrates the significant negative impact using a polymer with a high water vapor transmission rate (WVTR) can have on moisture sensitive electronics.



Determining Desiccant Requirements

Once the water vapor ingress rate has been established, calculations will be used to determine how much desiccant is required to maintain a non-condensing atmosphere over the service life of the product under special conditions. If the amount of desiccant required is not feasible due to space or weight requirements, alternate design options may need to be considered through selection of less permeable materi-



als for the assembly or possibly changing the service life intervals.

Our scientists have a keen understanding of the chemistry and functionality of the many types of desiccants, including various grades of silica gel, molecular sieves, calcium oxide, montmorillonite clays, to mention a few—each of which has its own adsorption characteristics. With their knowledge and experience, they can choose the correct desiccant formulation that will be the best fit to meet the needs of your device or application.

Since electronic products come in all shapes and sizes and have unique desiccant needs, there are many formats to choose from, including packets, sheets, tapes, compressed forms, and injection molded polymer composites. Compressed form desiccants, which can be formed to fit within a specific space in a device or package, are most widely used with electronic products as they offer higher desiccant loading in smaller configurations.

Desiccants integrated directly into a polymer composite can be injection molded into a functional component of the device, serving dual purposes. This method is perfect when the internal space to fit a desiccant is minimal.

The best time to introduce a desiccant into your product is early in the design process, but if you have a device that is experiencing issues from moisture, we have the experience and the expertise to evaluate your product and provide an optimized solution.

In additional to moisture management, we can help with oxygen absorption as well as the adsorption of many corrosive volatiles. Call Multisorb today to schedule a consultation.

"Remediation and Prevention of Moisture in Electronics," is the sequel to "Moisture in Electronics". Be sure to read this article as it explains in more detail the sources of moisture that can lead to product failure.