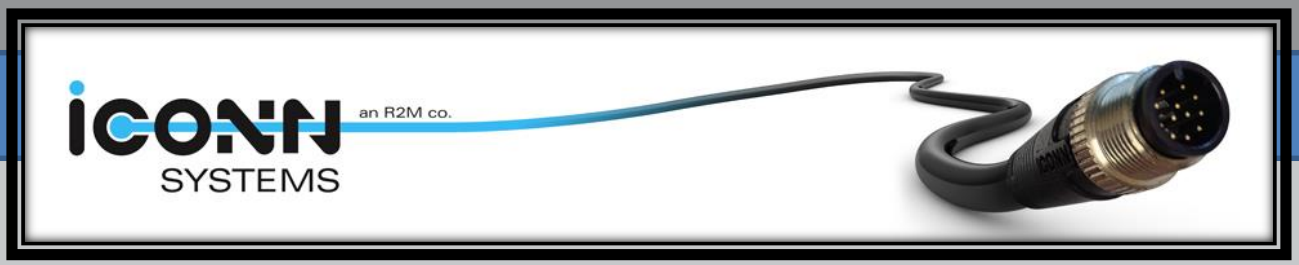

Molding Plastic and Managing the Moisture Monster

> Plastic and Moisture Whitepaper

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Introduction

Many plastic resins are “hygroscopic”. When resins are hygroscopic, the materials absorb and release moisture from the air depending upon the environment in which they are exposed and the duration of the exposure. This study examines the impact of moisture on plastic resins during the production process of molding the raw materials into finished products and examines steps that manufacturers should take in order to manage the moisture content in their resins. If the appropriate steps to control moisture when injection molding plastics is not taken, moisture is a monster.

Plastic Resins: The hygroscopic molding material

The majority of resins that are available in the marketplace are hygroscopic. In other words, the materials absorb moisture in humid air conditions and release moisture in arid or dry conditions. Hygroscopic resins include PA, PC, PET, ABS, Polyurethane, and PBT. Non-hygroscopic resins include PE, PP, PVC, and Polystyrene. Nylon 6 is one of the more hygroscopic resins and is capable of containing as much as 9% of its weight in moisture.

Manufacturers of plastic resins in many cases will dry the resin through the production process and package the product in sealed plastic bags. Depending upon your plastic resin supplier, the resins will be packed in polyethylene bags or in vacuum sealed bags intended to serve as moisture barriers. It’s important to note that while the plastic resin manufacturers may dry the material, polyethylene bags are not enough to prevent moisture from entering into the bag. Polyethylene bags are porous and will allow some amount of water into the bag.

For manufacturing companies that utilize these plastic resins, both hygroscopic and non-hygroscopic, in their injection molding process a general understanding of the water content must be understood in order to successfully mold parts with as little variation in their process as possible. Both hygroscopic and non-hygroscopic materials have the propensity to contain moisture. Hygroscopic materials can absorb moisture throughout the resin and non-hygroscopic materials can absorb moisture but it is only collected on the surface.

Hygroscopic Resins	Non-Hygroscopic Resins
PA (Nylon)	PE (Polyethylene)
PC (Polycarbonate)	PP (Polypropylene)
PET	PVC
ABS	Polystyrene
Polyurethane	
PBT	
TPU	
Cellulose	

Injection molding problems

When processing resins for injection molding, if the material is not properly dried to the manufactures recommended dryness, a variety of issues can and will occur. Of many potential defects that can occur from material not being properly dried, the most common of these occurrences are defects such as splay marks, irregular moldings, brittleness, lower mechanical properties, nozzle drool, bubbles, and sink marks. These defects can be controlled and eliminated through the use of equipment designed to properly dry resins.

Moisture Related Defects
Splay
Irregular Moldings
Brittleness
Lower Mechanical Properties
Nozzel Drool
Bubbles
Sink Marks

Methods in reducing moisture content

There are several methods for drying resins which utilize industrial drying systems prior to injection molding. The most common of these methods are the hot air dryer, desiccant dryer, compressed air dryer, and vacuum dryer.

Hot air dryers utilize a drying hopper where force air is heated and blown into the bottom of the hopper. As moisture is released from the resin, it is carried out through the top of the hopper. The amount of humidity that is in the air plays an impact on how dry the material will get.

Desiccant dryers are similar to hot air dryers except that instead of pulling in ambient air, the entire system is a closed loop so new and potentially humid air is not introduced into the desiccant drier. As moisture leaves the resin, a desiccant material that is extremely hygroscopic absorbs the moisture and releases the remaining air into the ambient environment.

Compressed air dryers bring in air through the bottom of the drying and expose the air to atmospheric pressure which causes the dew point to drop. The air with the lower dew point is then heated in order to increase its capacity to dry resin and is forced through the hoper thus drying the resin.

Vacuum drying is the latest technology in resin drying. Vacuum drying does just that, it vacuums or pulls moisture content from the resin. Some of the benefits with vacuum drying are reduced cycle time and a higher level of energy efficiency.

Controlling moisture in plastic resins

Utilizing drying systems alone is often not enough to improve the quality and consistency of your injection molding process. Monitoring the dew point and the moisture content of resins will help to ensure that your process for drying resins is capable of producing resin that meets the manufacturer's recommendation for resin dryness.

Dew point is the temperature at which plastic material is considered dry. Dew point meters are attached to industrial drying systems at the hopper outlet which monitor the resin to ensure that it has been thoroughly dried.

In addition to monitoring dew point, monitoring moisture content of resins is critical. It can lead to reduced waste and increase efficiencies. Moisture analyzers measure the percent of moisture that is present in resins prior to processing the plastic. This is done by heating samples of resin and measuring the weight loss of the sample. Adding moisture analyzers to the production process allow manufacturers to confirm that the resin is dried to the resins manufactures recommended level of dryness prior to injection molding. Many of these scales not only measure the moisture but store programs for a variety of resins and record the results.

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iCONN Systems use of desiccant drying systems

iCONN Systems, LLC is a custom engineered interconnect solutions design company that focuses on the manufacturing of electrical and electronic connectors, overmolded and discrete cable assemblies and value added turnkey products. Our design process continuously provides customers with high quality, cost effective designs for their specific applications, backed by superior customer service.

Our injection molding processes utilize desiccant drying systems with multiple hoppers which allows for quick cleaning of the hoppers and rapid material changes to better service our customers. We are pleased to announce that through our continuous improvement efforts and vertical integration, we've added a moisture analyzer to our injection molding and tooling department in efforts to further increase our level of traceability, productivity, and efficiencies.

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