

Dewpoint Measurement in Plastics Drying

To ensure the best quality and yield of end products plastics must be sufficiently dry before further processing. Using dewpoint measurement to control the dryer performance helps maintain high quality and reduces production costs. Vaisala offers both fixed and portable dewpoint measurement instruments for plastics drying applications.

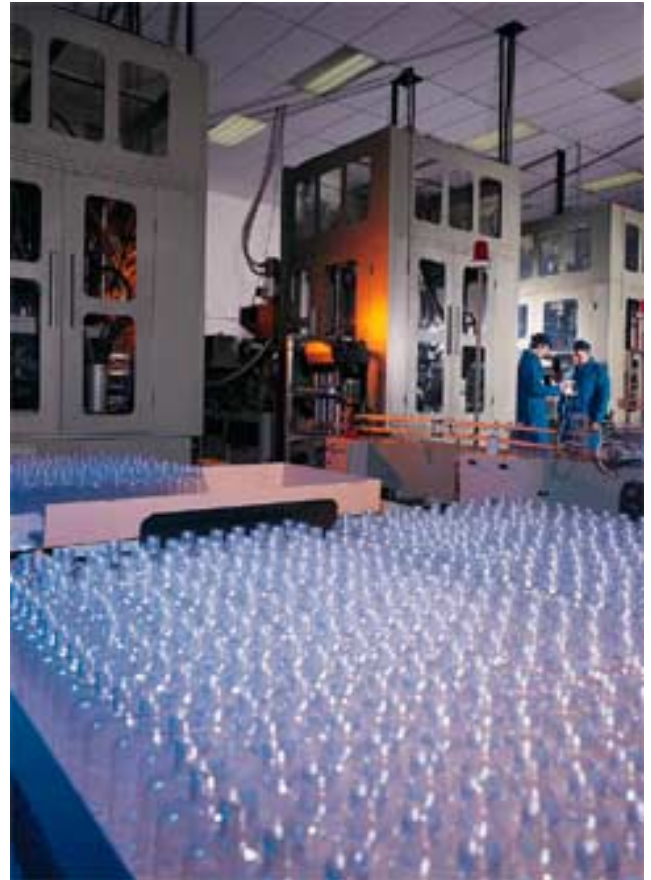
Plastics drying is an essential part of the injection molding and extrusion process. It is commonly known that hygroscopic materials, such as PET and nylon, require thorough drying. Most of the non-hygroscopic plastics benefit from drying, too. By drying the raw material, the unfavorable effects on the end products caused by excess moisture can be prevented. Excess moisture in plastics decreases the strength of the product and causes a poor finish on the surface of the product. The clearer the material the more likely cosmetic defects caused by underdrying will appear.

Drying Need Depends on the Plastic Used

The need of plastics drying depends on the storage conditions of raw materials and plastics type. Raw materials should be stored in a clean, dry environment. The materials stored in their unopened original packages are considered to be spec dried. If material is stored in an open bag or drum it is considered as wet material.

Hygroscopic materials, such as PET and nylon, are commonly used as engineering plastics. The drying of hygroscopic materials is a challenging process because of the internal moisture that is absorbed into pellet's or fiber's structure. Effective drying demands that the raw material is warmed up and then exposed to dry air in order to drive off the internal moisture. These plastics are dried using dehumidifying dryers such as desiccant dryers.

Non-hygroscopic materials, such as PP and PE, contain only surface moisture that might result from recycling or being stored in a moist place. The drying of non-hygroscopic



Effective Drying helps you to produce high quality end products. Drying is especially important when processing PET, e.g. soft drink bottles.

plastics does not require heating the whole pellet. Therefore, drying can be done by exposing the plastics to heated air, e.g. using hot air dryers. The ambient conditions can limit the drying result when using hot air dryers without dehumidified air. For example moist and warm weather makes drying more difficult.

It is strongly recommended that the raw material supplier is consulted for drying recommendations.

Dewpoint Measurement in Desiccant Dryers

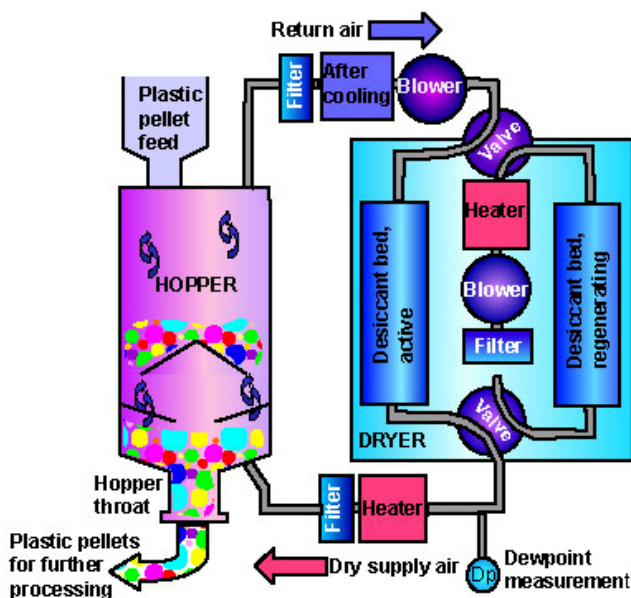
When drying hygroscopic materials a dehumidifying dryer is a must. Using a dehumidifying dryer with non-hygroscopic plastics can provide benefits for the user. For example weather related problems with drying can be minimized.

The most commonly used dehumidifying dryer type is a desiccant dryer. The advantage of desiccant dryers is their ability to produce dry enough air even for the most

hygroscopic materials. The dewpoint range for produced dry air ranges from -10 to -40 °C Td, even down to -60 °C Td, depending on the dryer type and application.

The operating principle of the desiccant dryer is quite simple: the dryer produces hot dry air that is blown through a duct to the hopper. The hot dry air removes moisture from the plastic chips in the hopper and circulates it back to the dryer. In the dryer, the air is cooled, the moisture is absorbed by the desiccant, and the air is reheated. The dryers typically have two desiccant filled towers with switching valves that direct the air flow between the two towers: while one tower is drying the air the other is in a regeneration mode flushing the collected moisture to the ambient.

In addition to detecting a possible failure in the dryer's operation, reliable dewpoint measurement can be used in controlling the desiccant regeneration interval. In practice this means that the dewpoint measurement controls the outlet air of the desiccant dryer. When the dewpoint increases over the set point the desiccant beds will shift. Dewpoint dependent switching provides the user with energy savings as well as a consistent quality of dry air output.



In order to achieve most reliable data about dryer performance, the dewpoint transmitter should be installed before the hopper.

Installation of Dewpoint Transmitter

It is recommended that the dewpoint transmitter is positioned before the hopper to measure the dewpoint of the air being passed into the dryer and over the chips. Due to the usually high temperature of the drying air, a measurement directly in the process is not always possible. If direct measurement is not possible, a sample tap can be installed. A sample system cools and, if needed, filters the air sample as it flows to the sensor, and then vents it out into the atmosphere. If the process has an underpressure or ambient pressure, the use of sample tap requires also a pump.

If the temperature is low enough, a direct installation in the process is possible.

Dewpoint Measurement Ensures the Dryer Performance

Dewpoint measurement indicates the quality of dry air produced in desiccant dryers. It is important to maintain the dewpoint at a certain level, depending on plastics, in order to achieve the optimum drying result.

Usually in large scale plastic dryers the dewpoint measurement is arranged with a fixed dewpoint transmitter that monitors the dryer performance on-line. The **Vaisala DRYCAP® Dewpoint Transmitter DMT242** is designed for use in continuous measurements in the large scale high quality plastics dryers used for demanding applications. DMT242 provides stable and reliable dewpoint measurement down to -60 °C Td. Such low dewpoints are used in PET drying. Wet PET chips can contain as much as 0.6% water by weight. Before further processing PET must be dried down to 0.003% (30 ppm) of water content. The required dewpoint in drying is lower than -40 °C Td. Due to advanced DRYCAP® technology, the measurement of DMT242 has fast response time, excellent long-term stability and the sensor is immune to most contaminants and condensation.

For demanding applications where monitoring of dry conditions is important and more options for dewpoint instrument are needed, Vaisala has the **Vaisala DRYCAP® Dewpoint and Temperature Transmitter Series DMT340**. It is a versatile, user-programmable dewpoint transmitter available with a display, alarm outputs and a mains power supply module. It is suitable for retro fittings due to its user friendly options and flexible structure: the dewpoint probe is fitted in the end of the

cable. DMT340 is the successor of the **Vaisala DRYCAP® Dewpoint Transmitter DMP248**.

Due to high quality needs, reliable on-line dewpoint measurement has become more important in smaller dryer types as well. The **Vaisala DRYCAP® Dewpoint Transmitter DMT142** is designed especially for dewpoint measurements in small/medium sized plastic dryers. The transmitter is small and easy to install in tight spaces.



The Vaisala DRYCAP® Portable Dewpoint Sampling System DSS70A is an easy-to-use solution for spot-checking dryer performance.

Spot-check to Ensure You Are Actually Drying

In case you have problems with end products, one of the first things worth checking is to see if your dryer is working properly. Therefore the dryer performance should be checked in regular basis. It is easy to check using a **Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70**. The DM70 enables fast response time and accurate dewpoint measurements down to -60 °C Td. Due to the meter's clear graphical display tracking the drying process trends is convenient. A data-logger function enables easy data collection just by pressing one button. The logged data can be downloaded to computer using the MI70 Link Windows® software.

The DM70 can be equipped also with **Vaisala Portable Dewpoint Sampling System DSS70A**. It is designed to provide the greatest amount of sampling flexibility for spot checking measurements. DSS70A is equipped with a battery powered pump that extracts a gas sample from dry

air circulation for measurement by the portable sampling system.

DM70 can also be used for a fast and easy field calibration check of Vaisala's fixed dewpoint transmitters DMT340, DMP248, DMT242 and DMT142 without removing the fixed installation. In addition, the DM70 can be used as a temporary display for fixed Vaisala transmitters that have no display.

Photos:

- PET bottle line, Digital Vision / Industry in Action
- DSS70A in action, Heikki Joensuu, Vaisala Oyj