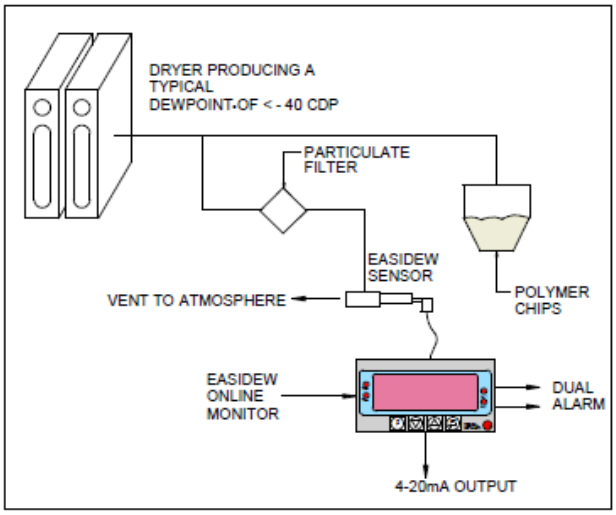
Improving the quality of polymer chips (polyethylene terephthalate) through moisture measurement

Application background

Polyester polymer chips such as PET are hygroscopic, meaning that they absorb moisture from their surrounding atmosphere. This causes issues during the injection moulding and extrusion processes. As the PET is heated, the water contained within it hydrolyses the PET, which decreases its strength and aesthetic qualities.



This means that before the PET can be processed in a molding machine, as much moisture as possible must be removed from the resin. In atmospheric conditions the resin can contain as much as 0.6% water by weight. The chips are loaded into a hopper, hot dry air at around -50°Cdp is then pumped into the bottom of the hopper so that it flows up through the pellets, removing moisture on its way. The hot wet air leaves the top of the hopper and is first run through an after-cooler, because it is easier to remove moisture from cold air than hot air. The resulting cool wet air is then passed through a desiccant bed. Finally the cool dry air leaving the desiccant bed is re-heated in a process heater and sent back through the same processes in a closed loop. Chip moisture content must be less than 30ppm before processing. Any water present when the PET is heated rapidly hydrolyses the polymer, thereby reducing its molecular weight and damaging its physical properties.

One of the most important physical properties of PET is its intrinsic viscosity (IV). The IV of the material is dependent on the length of its polymer chains, the longer the chains are, then the higher the IV will be, and the stiffer the material will be. The wetter the chips are when they are heated, the lower their IV will be, and consequently the physical rigidity & integrity of the polymer will be reduced, and the appearance will be affected.

Measurement technique

1. Continuous On-line measurement

Individual dryers are monitored to ensure that the air supply is better than the specified dew-point temperature limit of -50°C dew point and so assures that the chip material is processed to a satisfactory degree.

Michell offers two products suitable for this type of installation:

a) QMA401 – where precision measurement with automated internal calibration is required, then the QMA401 Precision Moisture Analyzer can be installed near the inlet of the drying hopper, to check for leaks in the air path from the dryer. The dual alarm contacts can be linked to an indicator to warn maintenance staff when the dry air supply begins to deteriorate, or to act as a trigger for a PLC system.

b) For lower budgets, Easidew Online also be mounted near the hopper inlet, and its dual alarm system can be used to provide an air quality warning.

2. Spot checking

The MDM300, MDM50 or Easidew Portable Hygrometers can be used to check the efficiency of a drier under operational load. Using a portable hygrometer to perform spot checks at regular intervals offers a cost effective assurance of product quality. With easy operation and fast response to industrial standard dew points of less than -50°C multiple drying facilities can be monitored within reasonable time frames by maintenance personnel at low costs.

Where particulate contamination (dryer desiccant or polymer dust) is present at the sampling point, in line filtration is recommended.

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