

Effects of Moisture on Nylon

DOE provides insight to the effects of physical and mechanical properties in relation to moisture content of material at molding

Effects of moisture on molded nylon parts

DOE studies the effects of moisture content **at molding** in relation to physical and mechanical properties of the finished part

Testing parameters

The following testing parameters were used during the DOE.

- 1) Material was dried to 5 specific moisture levels prior to molding.
- 2) Material was molded utilizing the ISO standard tensile bar mold.
- 3) Sample 1 was tested as soon as molding was complete. Samples 2- 5 were tested after 24 hours of exposure to environment and sample 6 was tested after 48 hours of exposure.
- 4) Material Physical properties were tested utilizing standard ASTM test procedures.
- 5) Process adjustments **were** made to mold optimum parts.
- 6) Material utilized for DOE – N66G33HSLU.BK lot # 036M00030

Injection Molding Parameters

The process was adjusted to insure we had optimized parts. The table below shows processing parameters for each sample. Changes are highlighted.

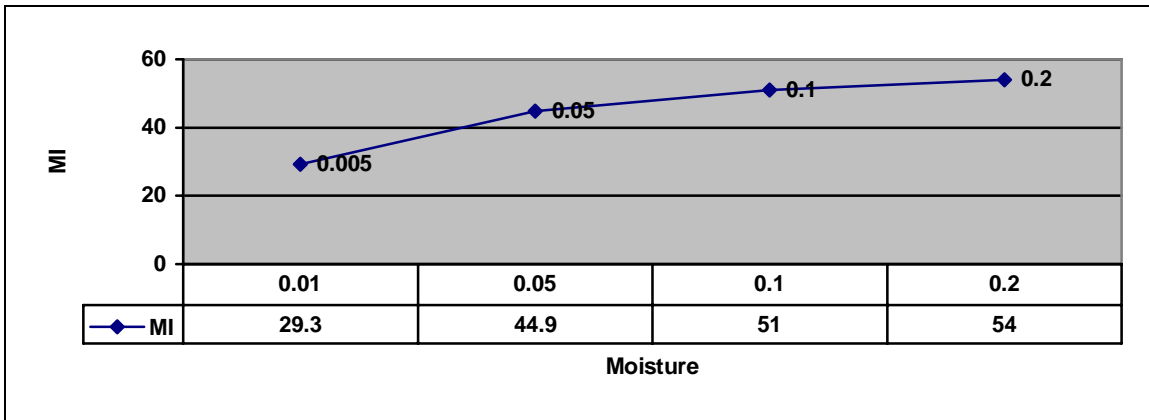
Sample	Moisture %	Inj. Boost time	Melt Index	Inj. Hold PSI	Inj. Hold Time	Back Pressure	Cushion	Transfer
1	.0069	4	29.34	800	18	50	.10	.40
2	.0069	4	29.3	800	18	50	.10	.40
3	.0586	4	44.9	700	18	50	.10	.40
4	.1120	4	51.5	625	18	50	.10	.40
5	.1763	4	54.6	625	18	50	.10	.40
6	.0586	4	44.9	700	18	50	.10	.40

As noted in the table you can see a significant change in the melt index as the moisture changes. This is significant to note and to make customers fully aware of what happens when over drying of nylon occurs and how the viscosity of the material is significantly raised.

The injection/hold pressures had to be adjusted to fill the part out adequately due to viscosity changes in the material at different moisture levels.

Moisture Effect on Melt Index

The following chart shows the effect of moisture on the melt index. As shown, moisture has a significant effect on the flow of the material.



Conclusion

The effects of moisture on processing nylon seem to be overlooked by a great number of processors. The thought process seems to be either that the material coming from the manufacture is dried so there is no need to dry it, or that the recommended drying parameters are given and that is what is followed. The minimal use of moisture analyzers provide ample room for over drying of materials which leads to significant changes in the viscosity of the material. The other side is the moisture content being on the high end causing finished parts to be brittle or material to run inconsistently. Knowing the moisture content of the material prior to processing is vital to producing optimum parts.

Although the mechanical properties did not show **significant** changes during this study due to the process changes, these changes to the process may not occur at a mold and the finished part may be compromised. If moisture content is lower this may lead to the part not being filled properly due to the higher viscosity of the material and the inability to pack the part out leading to the part size being smaller in dimension or brittleness. This may occur without visible signs but internal voids may be present. If moisture content is high this may also lead to internal voids (moisture molecules) that are due to moisture being trapped in the part, which may lead to reduced mechanical properties and brittleness.