NYLON IS A PAIN IN A DESIGNER'S (DESIGN ANXIETY)

The following is specifically related to nylon 6 and nylon 6,6, which are the predominant nylon products sold. Nylon 6 and nylon 6,6 are hygroscopic. Hygroscopic means readily taking up and retaining moisture. Many thermoplastics are hygroscopic. Nylon is unique in that the absorption of moisture results in physical property changes in the molded part post molding. Other thermoplastics absorb moisture post molding; however, most do not have physical property changes post molding. One of the purposes of this technical blurb is that Pounds of Plastic is soon to introduce a product line that has very similar performance characteristics as nylon without the design anxiety.

Nylon suppliers/manufacturers report physical properties "DAM" dry as molded and often "moisture conditioned". Often "moisture conditioned" physicals are not available. How does one design a part, then? DAM is as simple as measuring the physical properties of (in the case of a laboratory) test bars readily after molding. The bars are not allowed to absorb moisture prior to test. In the case of "moisture conditioned" the test bars remain in a controlled environment @ 50% relative humidity @ room temperature (23°C) for 48 hours. This conditioning is to simulate "real world". What happens when the ambient temperature is higher than 23°C and the relative humidity is greater than 50%? How flexible does an unreinforced nylon part become at 33°C and a humidity of 90%? We would have to test, as we do not have that information readily available.

There are significant differences between the physical properties of nylon parts DAM (dry as molded) versus "moisture conditioned" (often the term 50% R.H. is used for moisture conditioned data). This poses a challenge to designers. Once subjected to moisture the nylon exhibits a reduction in strength and stiffness. This means that moisture-conditioned nylon from the same batch is more flexible than dry as molded parts. The impact changes with moisture absorption in a positive manner. The parts get tougher after they have absorbed moisture. The dimensions of a nylon molded part also change. Absorption of moisture grows nylon parts. This can pose a problem depending upon the relative humidity. Note: nylon does not release its captured moisture easily.

The following chart compares the physical properties of HEXATHORPE 1000 (unreinforced nylon 6,6) DAM (dry as molded) to HEXATHORPE 1000 (50% R.H. conditioned physical properties. HEXATHORPE 1000 is **un**reinforced nylon 6,6. The following was conducted on virgin HEXATHORPE. Please note the percent change in these properties once the test bars had absorbed moisture. The HEXATHORPE 1000 becomes much more ductile after moisture absorption (see table below).

The designer must be aware of the ambient conditions that nylon parts will be exposed to. He/she must design for the ambient conditions and compensate for those conditions. If dimensions are critical then compensation must be made for the **growth** of the part post molding. In ambient conditiowns the parts will expand upon moisture absorption. What happens in Arizona? What happens to parts used in the Amazon River valley? The designer is faced with potential conditions that will change the performance of the nylon part(s).

Pounds of Plastic Inc. is therefore launching thermoplastic materials that have similar attributes to nylon, such as chemical resistance, wear resistance, toughness, lubricity, and heat performance. Post molding these products don't change physical properties and they don't grow. Stay tuned for the launch.

For more information on our **HEXATHORPE** nylons and our other products please see the 2021 Canadian Plastics Buyers' Guide, where we have a full page of our line card. Please contact **Dave Hamilton** (west) dave@poundsofplastic.com @ 647-233-8296 or **Kyle Geer** (east) kgeer@poundsofplastic.com @ 905-439-2832 for additional information and competitive price quotations. You can contact us through info@poundsofplastic.com or via phone @ 905-286-9894.

On another note: Pounds of Plastic is **NOT** a thermoplastic recycler. We can, however, assist in your recycling challenges via advice.

PROPERTY	ASTM TEST	DRY AS MOLDED	CONDITIONED	% CHANGE
Tensile Strength (MPa)	D638	83	62	25
Flexural Strength (MPa)	D790	90	41	54.4
Flexural Modulus (MPa)	D790	2759	1310	52.5
Elongation (%) Yield	D638	10	20	100
Notched Impact	D256	>1.0	<3.0	200