

NAN YA NYLON 66 Engineering Plastics

Flame Retardant · High Toughness · Heat Resistant ·
Impact Resistant · Moldability · Low Warpage





Introduction

NAN YA FR-NYLON 66 has water absorption properties like other nylons. Although NYLON 66 has lower water absorption than NYLON 6, it is still classified as a high water absorption material among engineering plastics. As a raw material supplier with relevant laboratory equipment and conditions, our company has provided laboratory statistics for client consideration.

NAN YA NYLON 66 Engineering Plastics Characteristics

1. NYLON 66 has a lower moisture absorption rate than NYLON 6.
2. High rigidity and high heat deflection temperature for injection molding.
3. Used for components requiring both high Rigidity and high toughness.
4. Low warpage and good surface for use as large external casings.
5. Products requiring flame retardant materials.
6. Products requiring strength, precision, anti-heat deflection and flame retardant materials.
7. Impact Resistance and quick molding.

PHYSICAL PROPERTIES

◆ Drying

1. NAN YA FR-NYLON 66 possesses water absorption properties like other NYLON. While NYLON 66 has lower water absorption than NYLON 6, it is still classified as a high water absorption material among engineering plastics. Hence, drying is a major step before molding.

Drying conditions are as listed in the table on the right.

Specific Gravity Reference

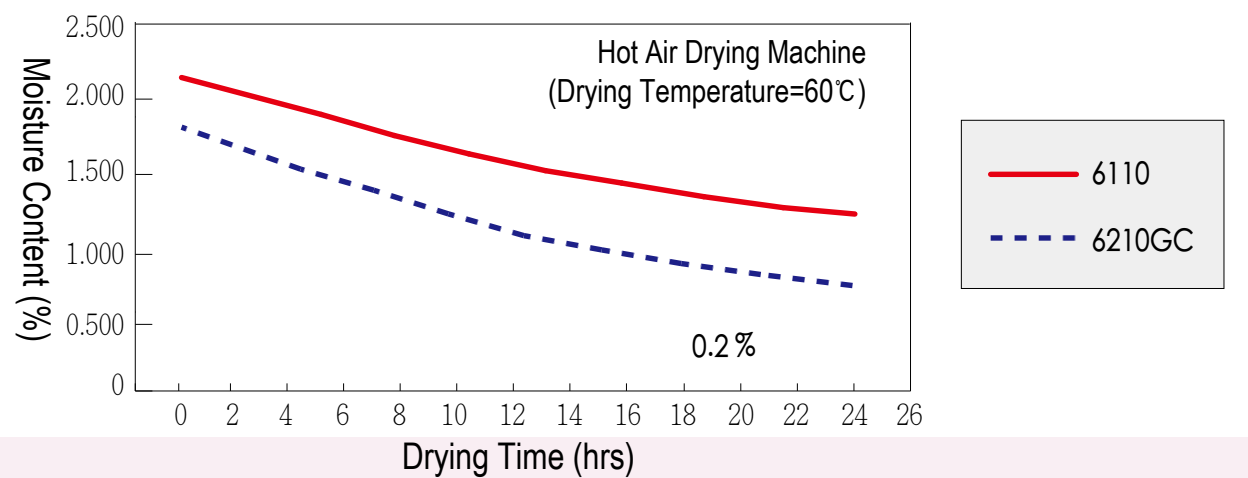
Drying Conditions	Drying Temperature (°C)	Drying Time (hrs)
0.2~0.3% (3~8hrs)	80	2 ~ 4
0.3~0.6% (8~24hrs)	80	4 ~ 8
0.6~2% (24hrs above)	80	8 ~ 24
Drying Machine: MATSUI-DMZ80 (Compared with ordinary grade)		

Type of Material	Moisture Saturation	
	20°C 50% relative moisture	20°C 100% relative moisture
PA6 Ordinary Grade	2.5~3.0%	9.0~11%
PA66 Ordinary Grade	2.3~2.8%	8.0~10%
PA6 Fiber Reinforced 30%	1.6~2.0%	6.0~8.0%
PA66 Fiber Reinforced 30%	1.4~1.7%	5.0~6.0%
Testing material: NAN YA PA6-2210 NAN YA PA6-2210G6 (plus fiber 30%) NAN YA PA66-6110 NAN YA PA66-6210G6 (plus fiber 30%)		

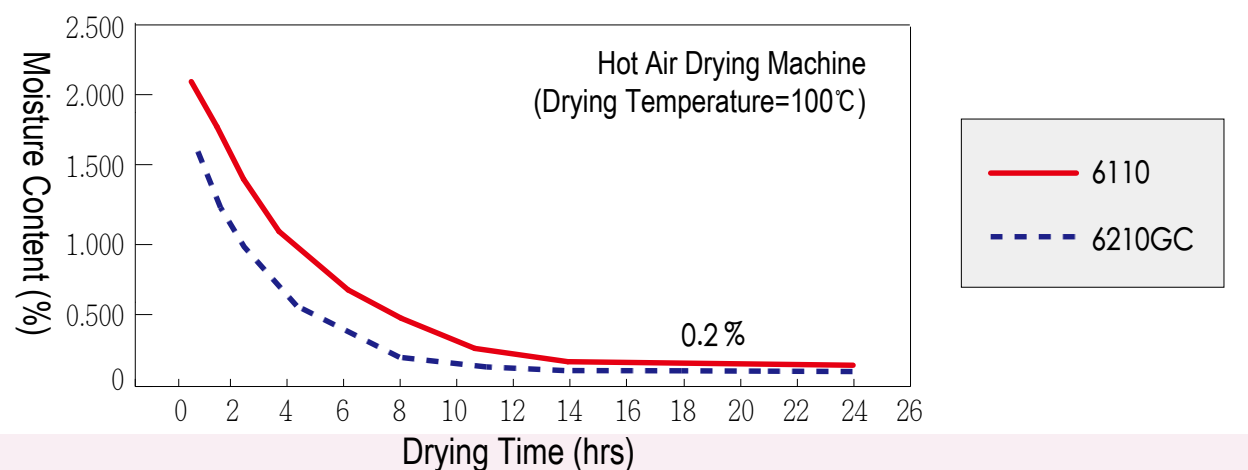


PHYSICAL PROPERTIES

Recommended drying temperature for NAN YA FR-NYLON 66 is 80°C . When temperature is below 80°C , drying results are not desirable, while at temperatures over 100°C , drying results are optimal but improper operations will lead to yellowing or inferior product quality, so extra caution must be taken. The relations between drying temperature, drying time and moisture content of NAN YA FR-NYLON 66 ordinary grade (6110) and reinforced grade (6210GC) are as provided. Please refer to Tables 1 and 2 and Graphs 1 and 2.



Graph 1: Relation of drying temperature and drying time and moisture content



Graph 2: Relation of drying temperature and drying time and moisture content

Table 1: Relation of Drying Time and Moisture Content at 60°C Drying Temperature

60°C Drying Time	Moisture Content (%)	
	6110	6210GC
0	2.10	1.70
1	2.05	1.68
2	1.98	1.66
3	1.90	1.64
4	1.83	1.62
6	1.78	1.53
8	1.78	1.33
14	1.51	1.05
24	1.27	0.79

Drying machine: matsui-dmz80

Table 2: Relation of Drying Time and Moisture Content at 100°C Drying Temperature

100°C Drying Time	Moisture Content (%)	
	6110	6210GC
0	2.10	1.70
1	1.67	1.32
2	1.40	0.98
3	1.18	0.74
4	0.93	0.62
6	0.73	0.43
8	0.50	0.19
14	0.12	0.10
24	0.08	0.05

Drying machine: matsui-dmz80

PHYSICAL PROPERTIES



Table 3. shows the natural moisture absorption tests of NAN YA NYLON 66 ordinary grade (6110) and NAN YA NYLON 6 ordinary grade (2110) to better understand the relation between moisture absorption time and moisture content (Please refer to Graph 3).

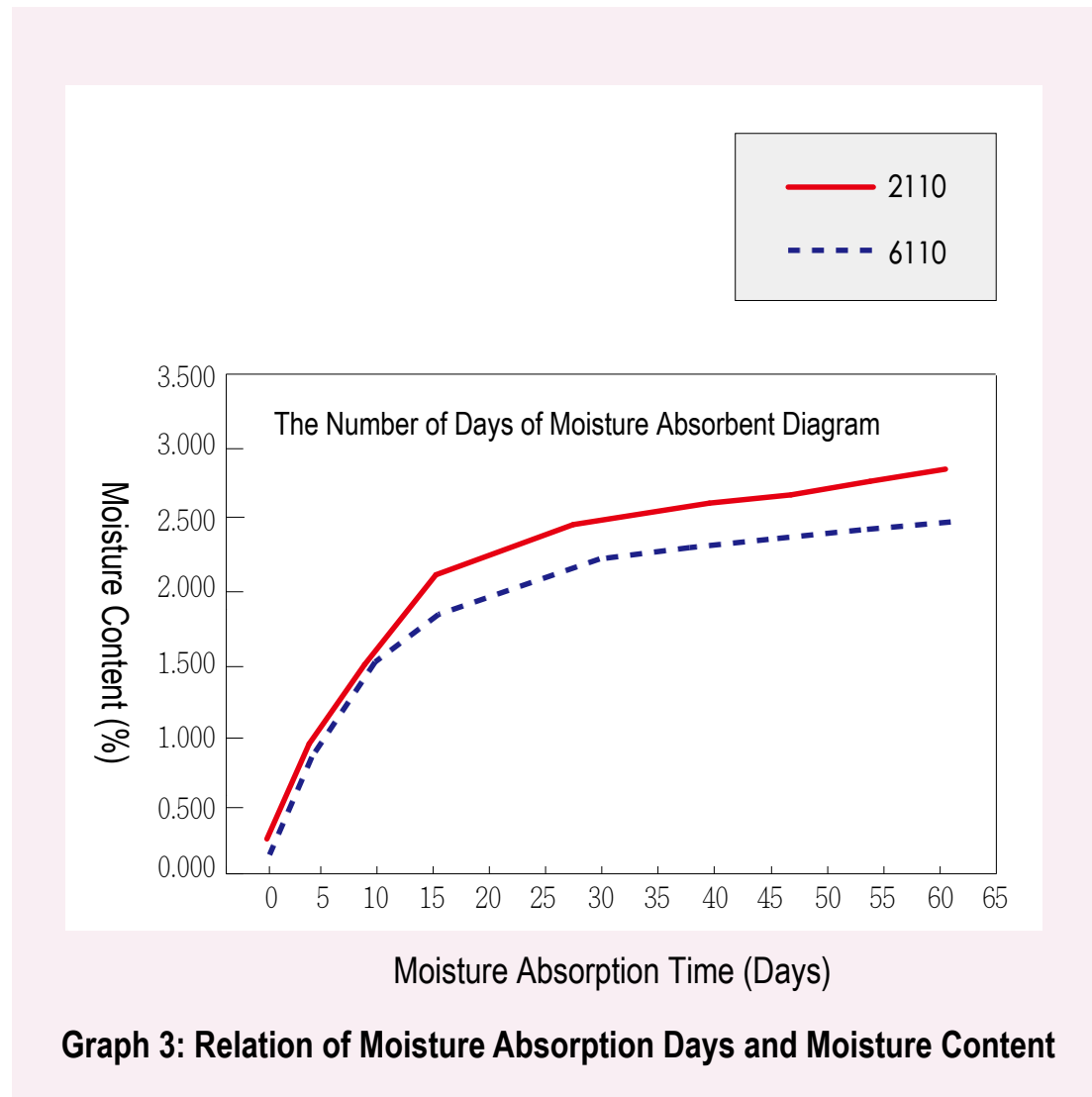


Table 3: Relation of Moisture Absorption Days and Moisture Content

Moisture Absorption Time (Days)	Moisture Content (%)	
	2110	6110
0	0.151	0.131
1	0.620	0.501
2	0.750	0.689
3	0.893	0.773
4	0.987	0.899
5	1.012	0.971
6	1.215	1.210
7	1.430	1.390
8	1.522	1.486
14	2.221	1.959
30	2.541	2.350
45	2.711	2.401
60	2.890	2.501

Moisture Absorption Conditions: 23°C Relative humidity: 50%



PHYSICAL PROPERTIES



Table 4. shows the natural moisture absorption tests NAN YA NYLON 66 30% fiber reinforced (6210G6) and NAN YA NYLON 6 30% fiber reinforced (2110G6) to better understand the relation between moisture absorption days and moisture content of FR-NYLON 6/66 under natural moisture absorption conditions (Please refer to Graph 4).

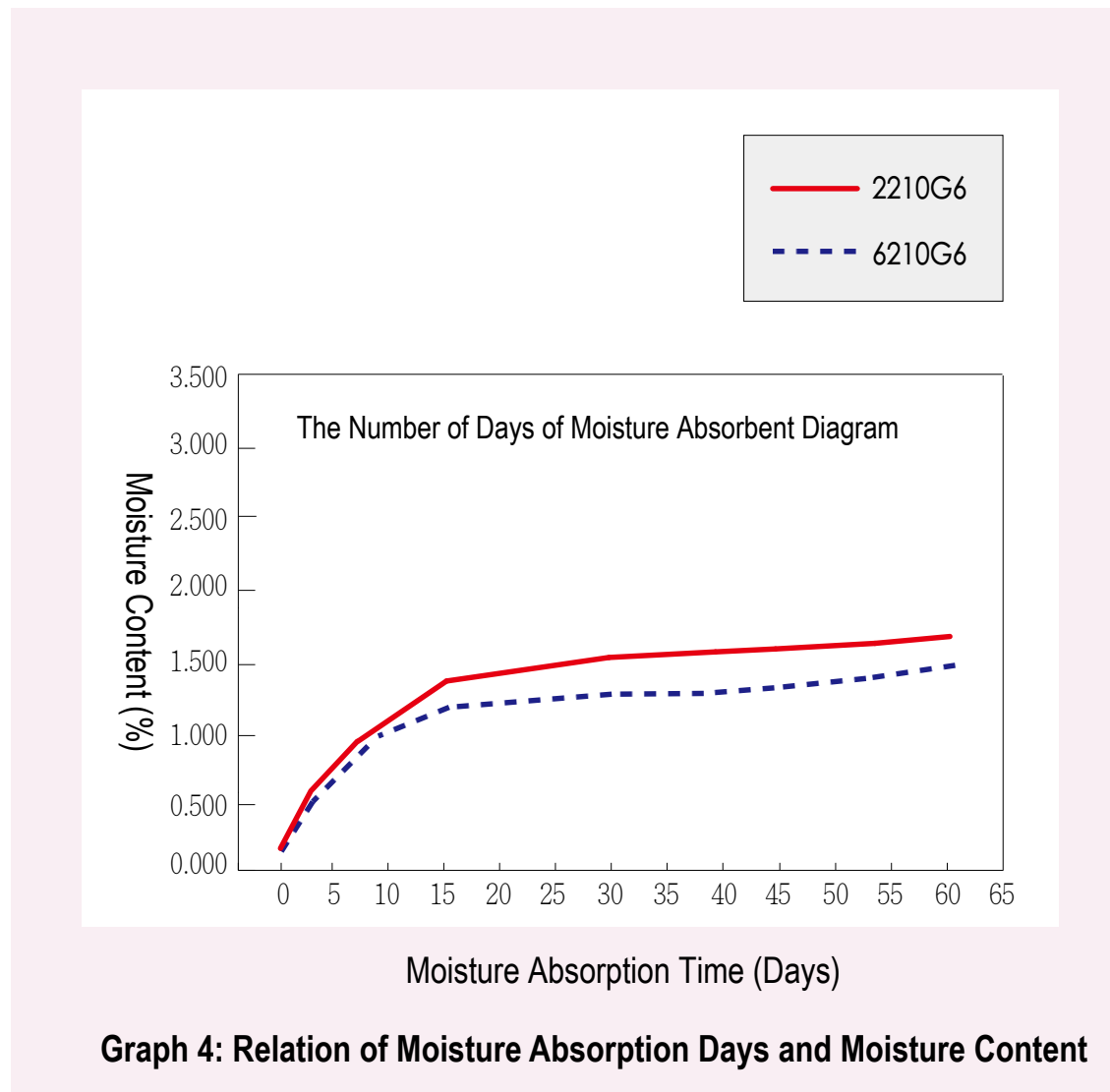


Table 4: Relation of Moisture Absorption Days and Moisture Content

Moisture Absorption Time (Days)	Moisture Content (%)	
	2210G6	6210G6
0	0.105	0.103
1	0.428	0.331
2	0.601	0.588
3	0.735	0.601
4	0.814	0.650
5	0.823	0.701
6	0.935	0.799
7	0.974	0.834
8	1.050	0.989
14	1.426	1.237
30	1.595	1.349
45	1.645	1.443
60	1.700	1.521

Moisture Absorption Conditions: 23°C Relative humidity: 50%



PHYSICAL PROPERTIES



◆ NAN YA NYLON Series Packaging Specifications

The packaging will use a 3 layered Kraft paper and Aluminum foil bag.

Exterior Layer – Kraft Paper

Second Layer – PP Woven Cloth

Third Layer – PE laminated PET plated aluminum foil bag

After long term moisture tests, under normal storage conditions, package may remain sealed, allowing moisture content to remain below 0.1Wt% for 6 months. But if a paper package or pp woven cloth package is used, moisture absorption will be more severe. Below are moisture absorption rates of paper bag and natural moisture absorption.

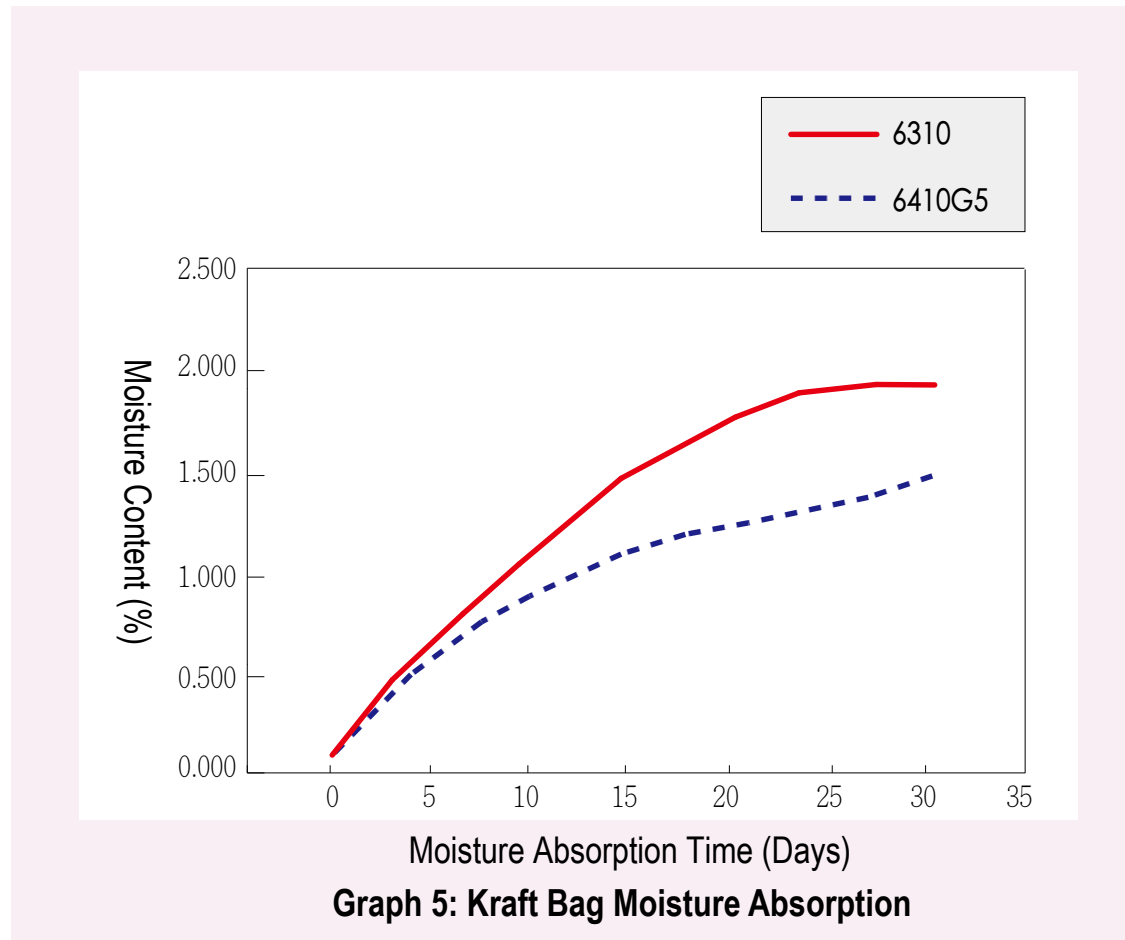


Table 5: Relation of Moisture Absorption Days and Moisture Content

Moisture Absorption Time (Days)	Moisture Content (%)	
	6310	6410G5
0	0.125	0.102
1	0.358	0.274
2	0.459	0.377
3	0.575	0.471
4	0.690	0.523
5	0.734	0.602
6	0.925	0.875
7	0.996	0.885
8	1.101	0.943
14	1.300	1.180
22	1.987	1.337

1. Moisture absorption conditions:
23°C relative humidity: 50%

2. Kraft paper bag construct
Exterior layer – kraft paper
Second layer – PP woven cloth
Third layer – PE laminated PET plated aluminum foil bag

Table 6: Natural Absorption of Plastic Particles Absorption Days and Moisture Content

Moisture Absorption Time (Days)	Moisture Content (%)	
	6110	6210G6
0	0.131	0.103
1	0.501	0.331
2	0.689	0.588
3	0.773	0.601
4	0.899	0.650
5	0.971	0.701
6	1.201	0.799
7	1.390	0.834
8	1.486	0.834
14	1.959	0.989
30	2.350	1.349
45	2.401	1.443
60	2.501	1.521

Moisture Absorption: 23°C
Relative Humidity: 50%



PHYSICAL PROPERTIES

◆ Molding Conditions

Table 7. lists the injection mold eference conditions of NAN YA FR-NYLON 66 bulk specifications, including recommended cylinder temperature settings, injection pressures, and injection speeds. As different materials have different characteristics, following the characteristics will allow smooth production and retain original properties, hence the table on the right is a major source of reference.

Table 7: Injection Conditions of NAN YA FR-NYLON 66

Models		6110	6210GC	6210G9	6214GC
Drying Temperature	°C	80	80	80	80
Drying Time	Hrs	4	4	4	4
Nozzle Temperature	°C	275~295	275~295	275~295	275~285
Cylinder Temperature	Front	°C	270~285	270~285	275~285
	Center	°C	265~275	265~275	265~280
	Rear section	°C	260~265	260~265	260~265
Mold Temperature	°C	60	90~110	90~110	90~110
Injection Pressure	kg/cm ²	600~1500	600~1800	600~1800	600~1800
Screw Rotation Speed	rpm	120~160	120~160	120~160	120~160
Injection Speed	–	Medium~Fast	Fast	Fast	Fast
Molding Shrinkage (Test Thickness 3mm)	Flow %	1.2~1.8	0.2~0.4	0.2~0.3	0.2~0.3
	Vertical %	1.2~1.5	0.7~0.9	0.6~0.9	0.6~0.9

Models		6310	6410G5	6512
Drying Temperature	°C	80	80	80
Drying Time	Hrs	4	4	4
Nozzle Temperature	°C	265~275	270~280	265~275
Cylinder Temperature	Front	°C	260~270	260~270
	Center	°C	260~265	255~260
	Rear section	°C	250~260	250~255
Mold Temperature	°C	90~110	90~110	60
Injection Pressure	kg/cm ²	600~1500	600~1500	600~1500
Screw Rotation Speed	rpm	120~160	120~160	120~160
Injection Speed	–	Fast	Fast	Medium
Molding Shrinkage (Test Thickness 3mm)	Flow %	0.2~0.4	0.2~0.3	1.2~1.3
	Vertical %	0.7~0.9	0.6~0.9	1.3~1.4

PHYSICAL PROPERTIES



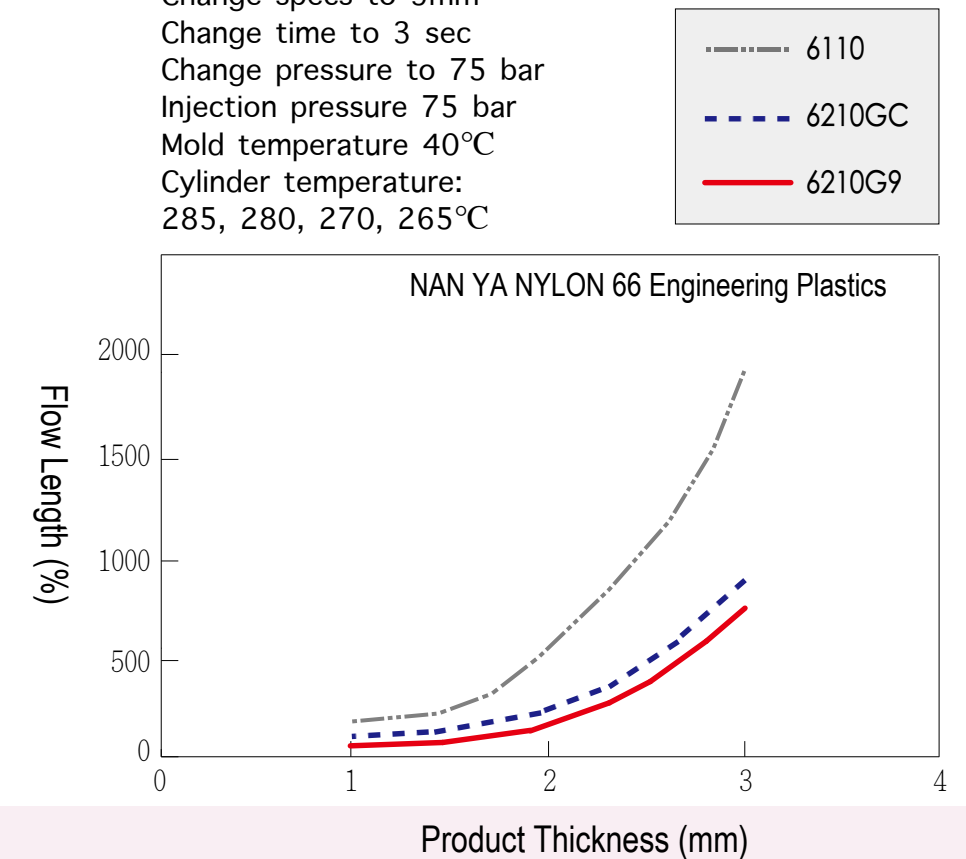
◆ Flowability

1. A good flowability does not mean that the plastic is easy to mold, nor does a plastic with poor flowability represent poor moldability. Materials should be selected based on their properties while products and molds should be designed with material properties in mind. Only by matching both ends can the products be optimized. For most plastics, product thickness presents a large influence over the flowability (L/t ratio, L: Flow Length, t: product thickness). From Graph 6, when we compare NAN YA ordinary grade (6110), 33% fiber reinforced grade (6210GC) and 45% fiber reinforced grade (6210G9), when product thickness increases from 1mm to 3mm, the difference of 2mm will cause significant impacts on the flowability. This is why product designs should avoid uneven thickness.
2. Normally, mold temperatures have different effects on plastic materials. Some of these effects are:
 - a. Increase plastic flowability in mold.
 - b. Improve glossiness of product appearance.
 - c. Special functions such as when PET is subject to high mold temperatures during molding, the heat deflection temperature also increases.

In most cases, NYLON ordinary grade does not require higher mold temperatures to increase glossiness of the product. Instead, under high mold temperatures, the product may undergo shrinkage and form surface defects. (This is because normal molding temperature is between 60°C ~90°C). For the reinforced grade to form a better surface, the mold temperature should be increased. This is especially so for materials with increased fiber contents. Graph 7 shows an increase in flowability in ordinary grade (NAN YA 6110) and ordinary flame resistant grade (NAN YA 6310) at 100°C mold temperatures. Reinforced grades (NAN YA 6210GC and 6210G9) require mold temperatures of above 120°C to reflect increases in flowability.

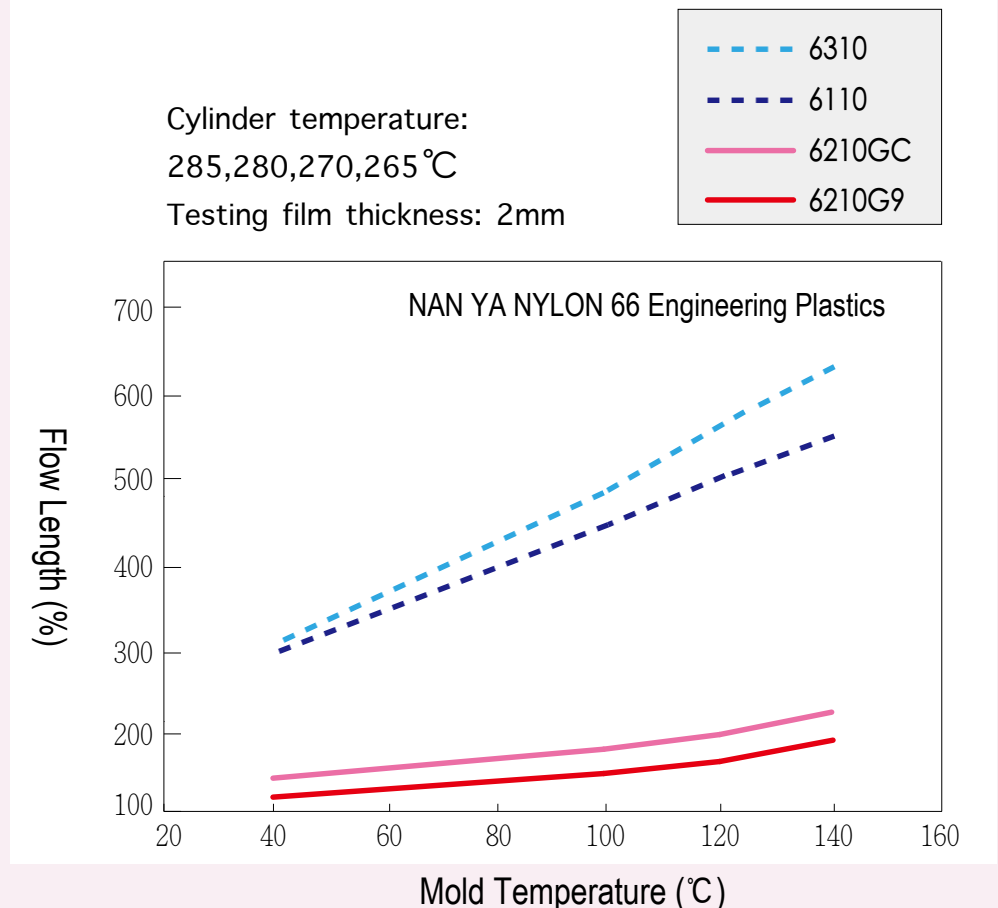


Processing conditions:
Change specs to 5mm
Change time to 3 sec
Change pressure to 75 bar
Injection pressure 75 bar
Mold temperature 40°C
Cylinder temperature:
285, 280, 270, 265°C



Graph 6: Influence of Product Thickness on Flow Length

Cylinder temperature:
285,280,270,265°C
Testing film thickness: 2mm



Graph 7: Influence of Mold Temperature on Flow Length

PHYSICAL PROPERTIES

USES OF RECYCLED MATERIAL



3. Graphs 8 and 9 show the flowability of NAN YA FR-NYLON 66 bulk specifications.

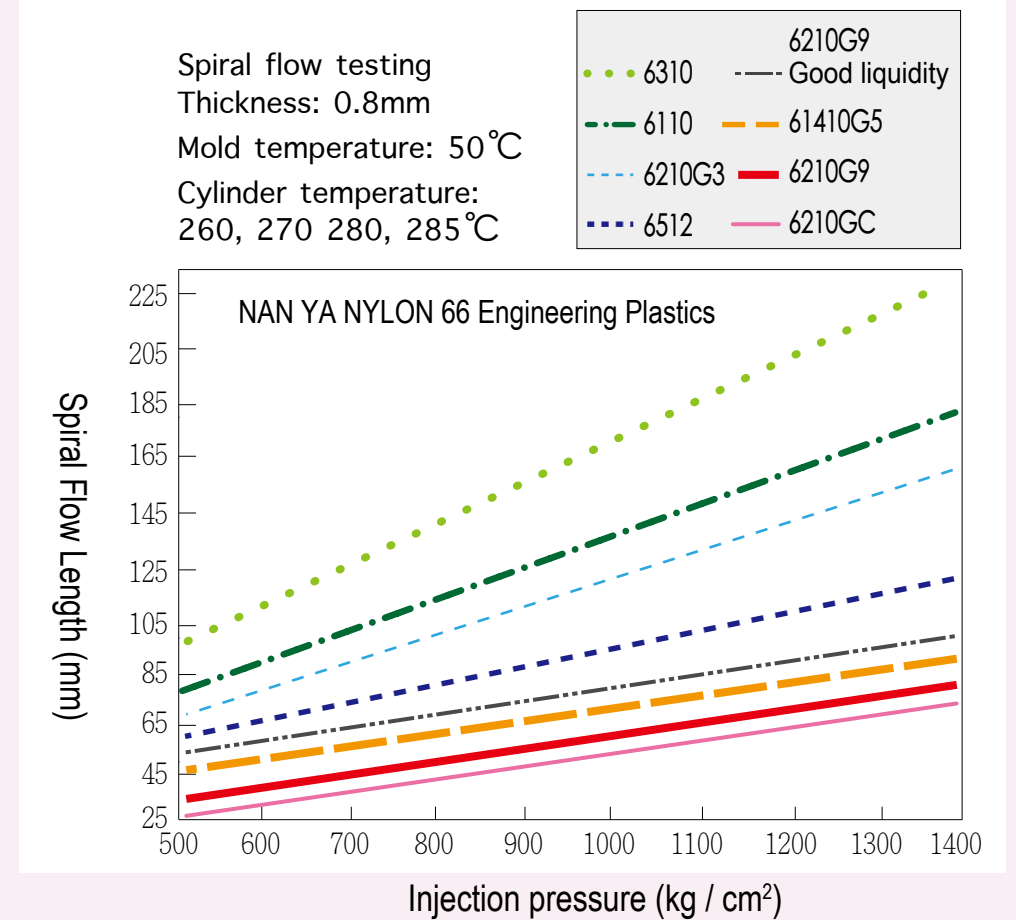
Recycled materials refer to the inferior products or residue materials in the cylinder that are crushed into particles for ease of recycling. But due to pollution issues during recycling, the physical properties of recycled material quality will decrease and the material will suffer color changes due to pollution and heat decomposition of resin. These are the common issues of recycled materials. Below are precautions to be taken during recycling:

- Recycled material in the mixture should be below 20%, or as low as possible.
- Avoid recycling materials that have long residence times or have suffered pyrolysis and color changes due to high temperatures.
- Ensure material feed cylinder remains free of pollution during recycling.
- Check the crushing machine before using to avoid impurities or mixing.
- The container holding recycled materials should be clean and should be capped to prevent pollution from dust or impurities.
- During crushing, powder particles may be formed and should be filtered to prevent the pyrolysis of the powder from causing defective products.
- When changing materials, the initial material from nozzle should not be used in order to prevent the mixing of materials.
- Recycled materials should be dried before using.

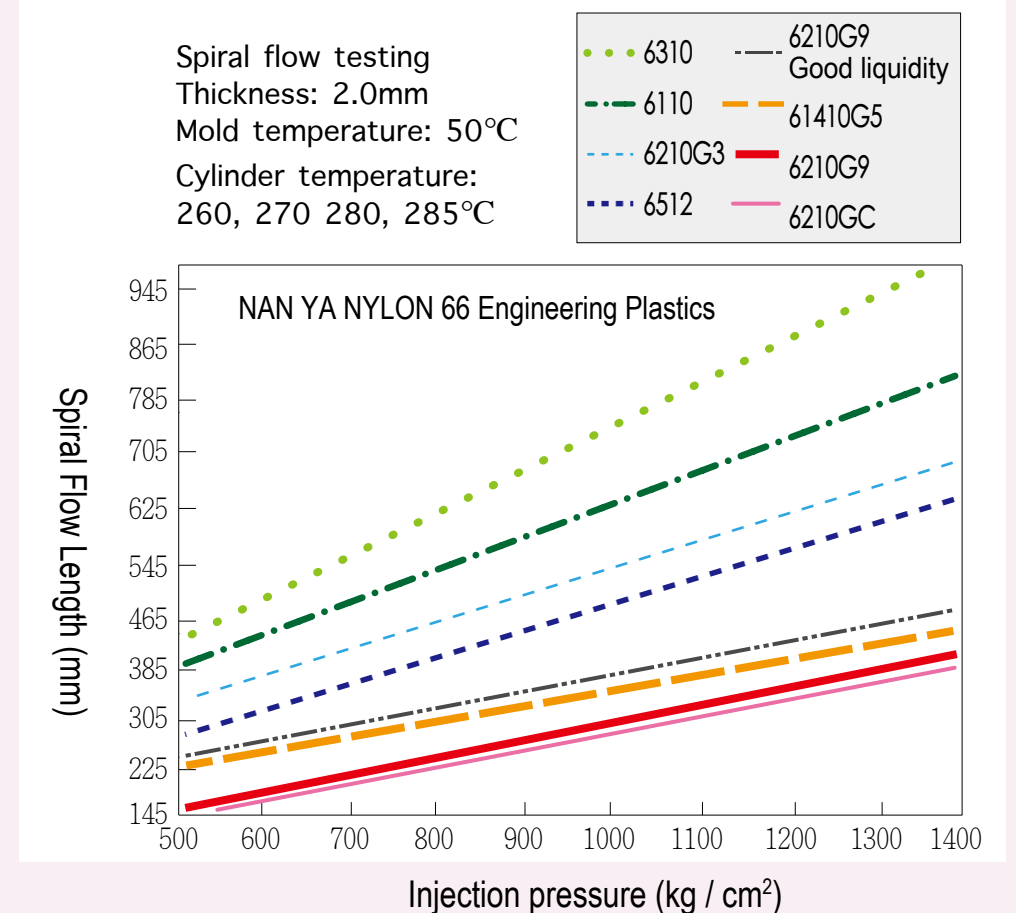
The aforementioned mentioned precautions should be taken to ensure cleanliness and reduce pollution so that quality of the recycled material may be ensured and production may be completed smoothly.

Note: Under normal conditions, when using recycled materials, the biggest impact will be on the reinforced flame resistance grade and the ordinary flame resistance grade. Improper operations or carelessness during recycling will be major causes for reduction in physical properties, therefore 3 common causes for abnormalities are provided:

- Using large machinery to produce small products
- Cylinder temperatures are too high.
- Abnormal residence time.



Graph 8: Influence of Injection Pressure on Flow Length



Graph 9: Influence of Injection Pressure on Flow Length



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