General processing

Tao Wu, 13585720288
Lanxess Chemical (China) co., ltd.

LANXESS

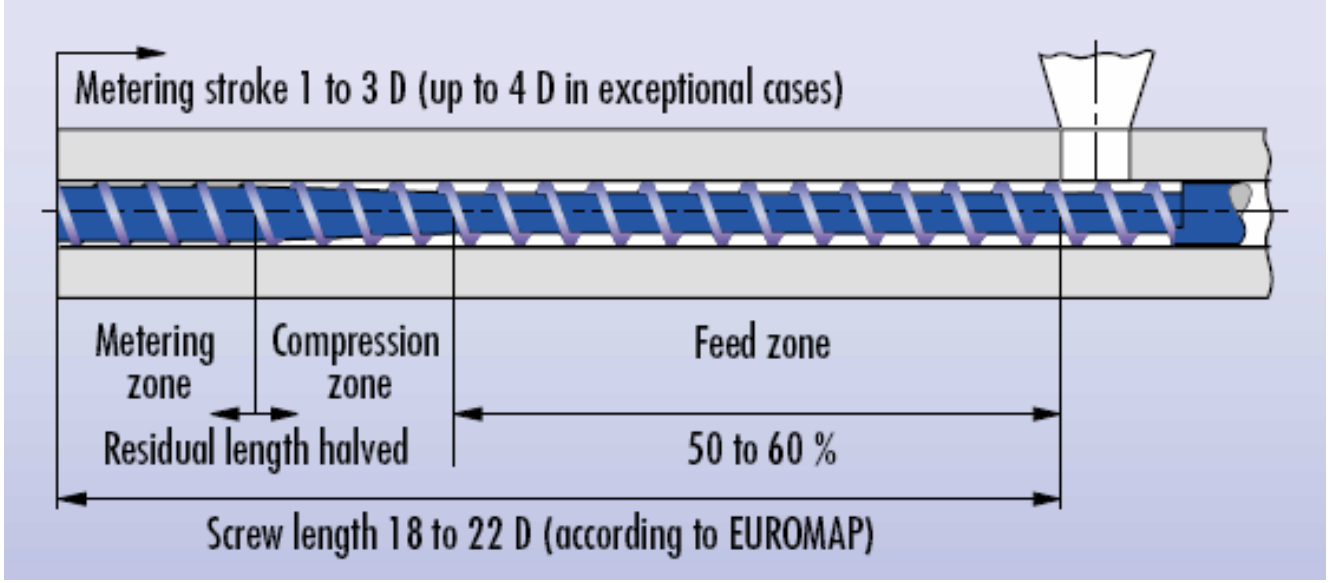
Injection molding

- Machinery
- parameters
- defects and counter actions
- deformation

Injection/machinery

1. injection machine
   - plasticization unites
   - mounting mould
   - clamping force
2. mould temperature controller
3. dryer
4. jig and fixture

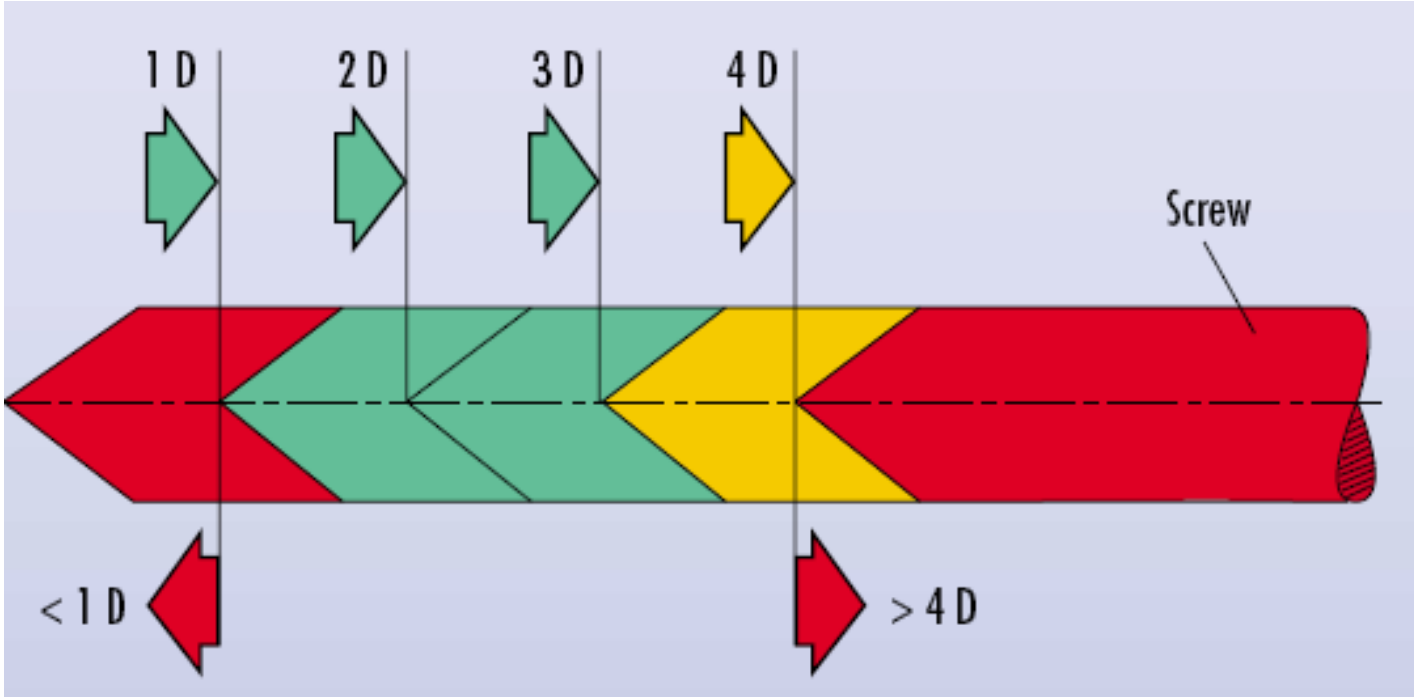
Injection/machinery/*plasticization unites*



Standard three-section screw, to produce material with glass fiber, alloy screw needed

LANXESS

Injection/machinery/*plasticization unites*



optimum metering range: 1D-3D

LANXESS

Injection/screw size

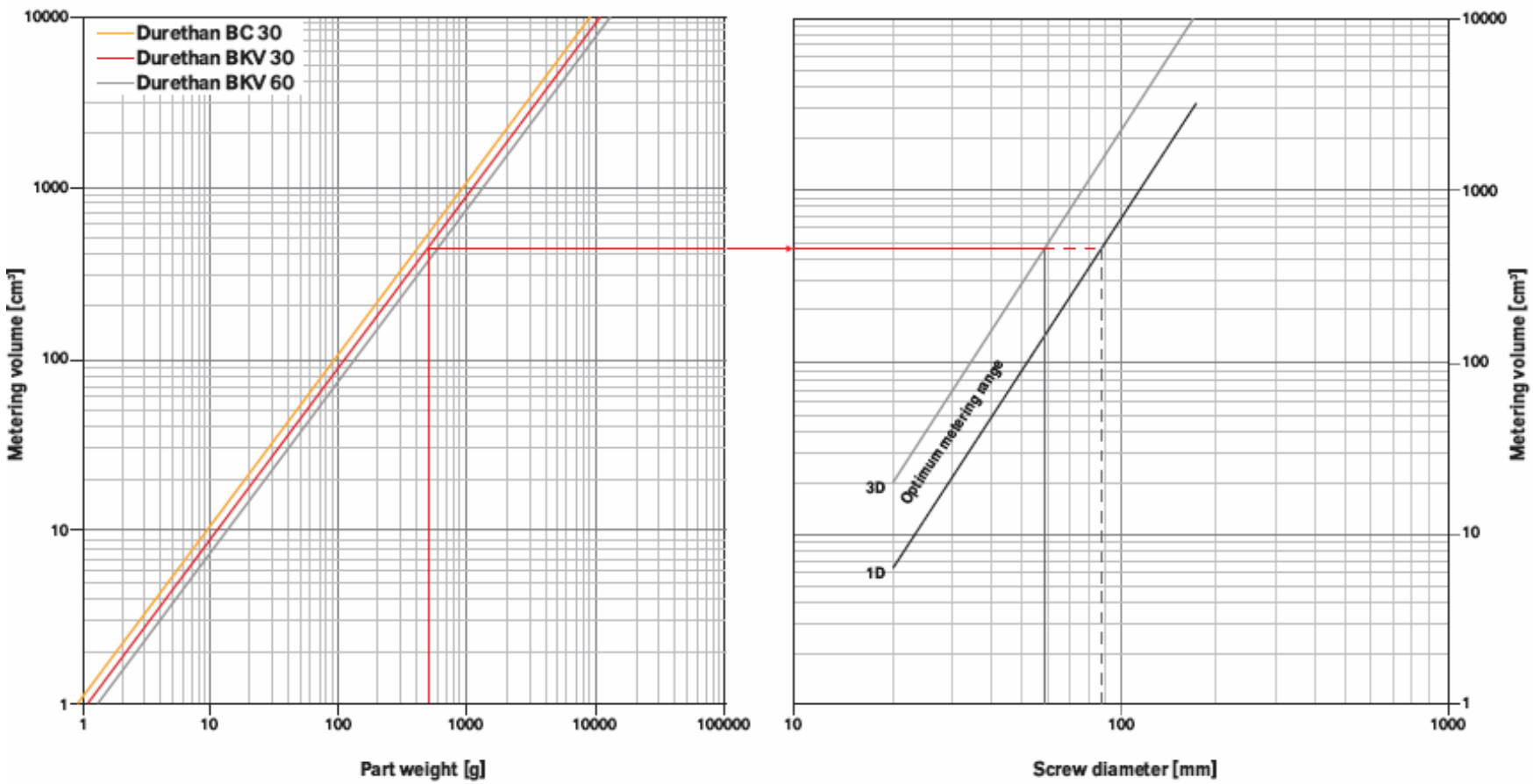


Fig. 6a: Correlation between screw diameter, metering volume and part weight for the injection molding of Durethan®

Injection/machinery/*plasticization unites*

Meeting stoke >4D → air streaks and air bubble

Meeting stoke <1D → long residence time → degradation

Injection/parameters

- Temperature
  - ➢Melt temperature
  - ➢Mould temperature
- Injection speed, time and pressure, screw position
- Holding time and pressure
- Metering
- Cooling
  - ➢metering stroke and time
  - ➢back pressure

LANXESS

Injection/**parameters**/*temperature*

° C	Melt temperature		Mold temperature	
	reinforced	unreinforced	reinforced	unreinforced
PA6	270-290	260-280	80-120	80-100
PA66	280-300	270-290	80-120	80-100

Residence time depends on melt temperature.
Normally residence should be lower than 10 minutes.

LANXESS

Injection/**parameters**/*injection*

- To obtain good part surface, high injection speed is preferred.
- Injection pressure is requisite for injection speed: the set value of injection pressure on machine is just a permitted value.
- Injection time must be enough to guarantee the screw movement.
- Profiled injection to avoid some defects.

LANXESS

Injection/**parameters**/*holding*

- The purpose of the holding is to offset material shrinkage by conveying more melt into cavity.
- Holding influences shrinkage and warpage.
- Holding effect depends on material type, gate position and size.
- The holding pressure should only be just high enough to ensure that voids and sink marks do not occur on molded parts of “good plastic design”.

LANXESS

Injection/**parameters**/*metering*

Too high metering speed will lead to poor plasticization effect and also to moisture absorption. The peripheral velocity of screw should be between **0.05-0.2**m/s. The rotation speed is accordingly about **1000/D-4000/D** /min

Too little back pressure will also lead to moisture absorption. But too high back pressure will lead to plasticization difficulty.

Proper back pressure can ensure melt homogeneous.

For Durethan, the proper back pressure is 5-15bar(hydrolic pressure).

LANXESS

Injection/warpage

Factors Affecting Shrinkage

LANXESS

Injection/warpage

Possible Causes of warpage:

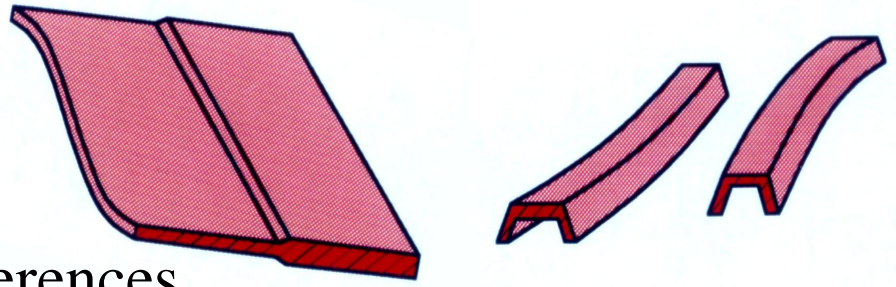
- non-uniform shrinkage
- non-uniform cooling
- orientation effect
- others

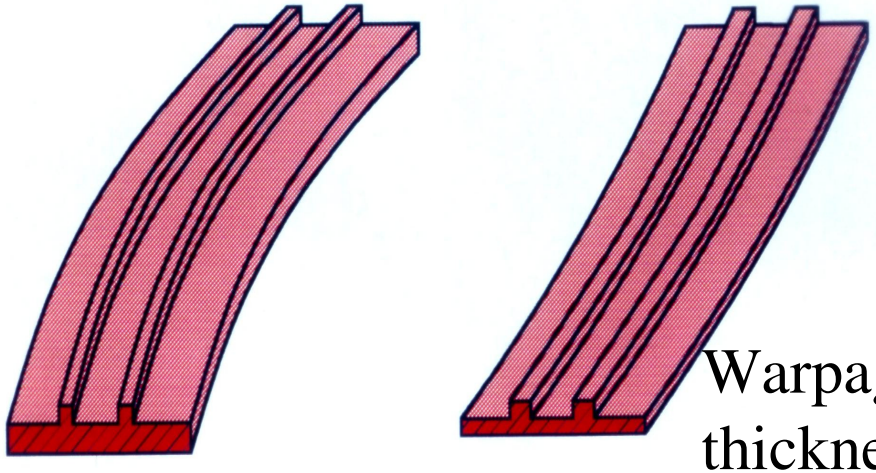
LANXESS

Injection/warpage

Warpage due to none-uniform shrinkage

Warpage due to
wall thickness differences



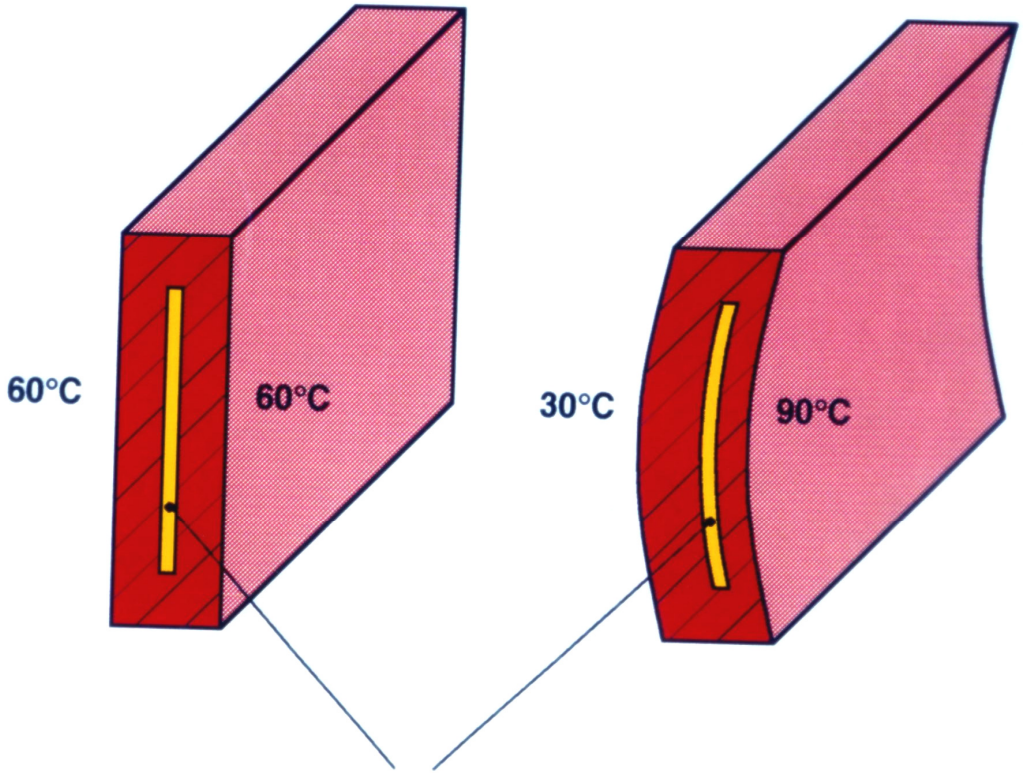


Warpage due to rib/wall
thickness differences

LANXESS

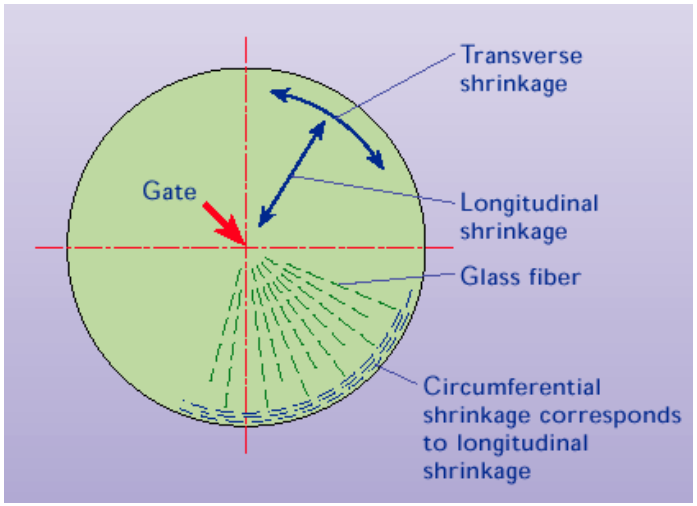
Injection/warpage

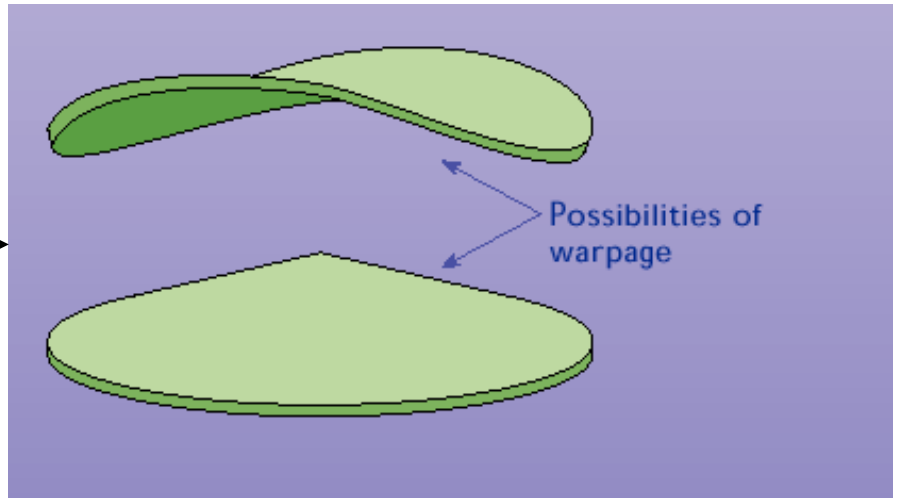
Warpage due to Non-uniform Cooling



Injection/warpage

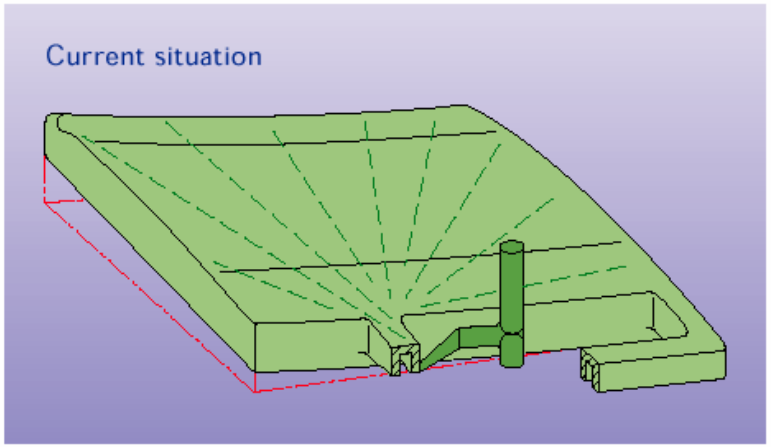
Warpage due to orientation effect

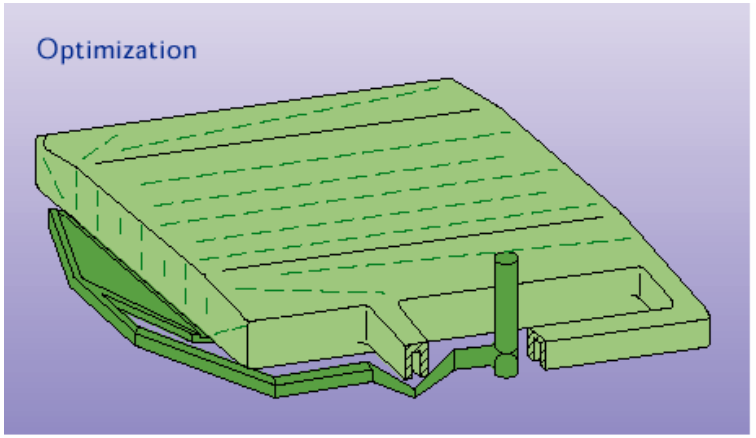




Injection/warpage

Warpage due to orientation effect





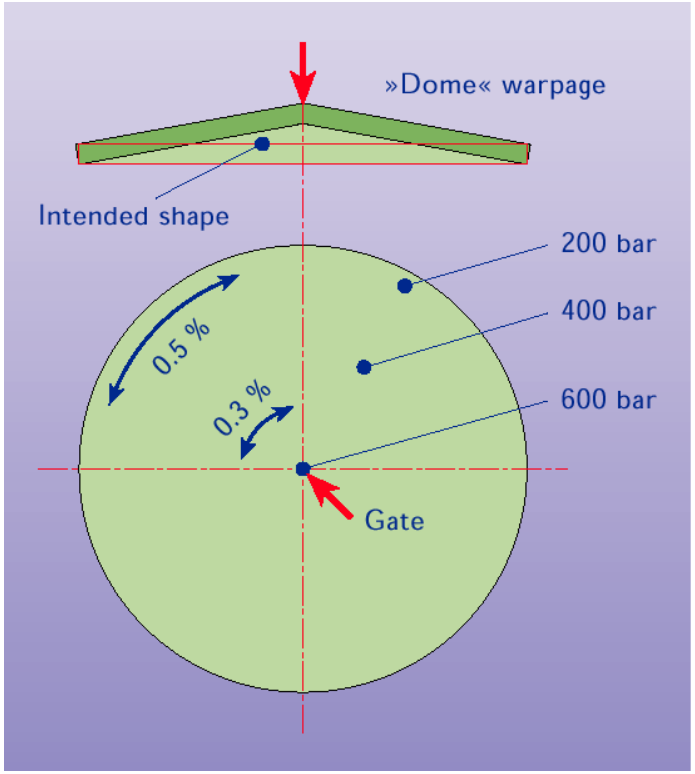
Poor design

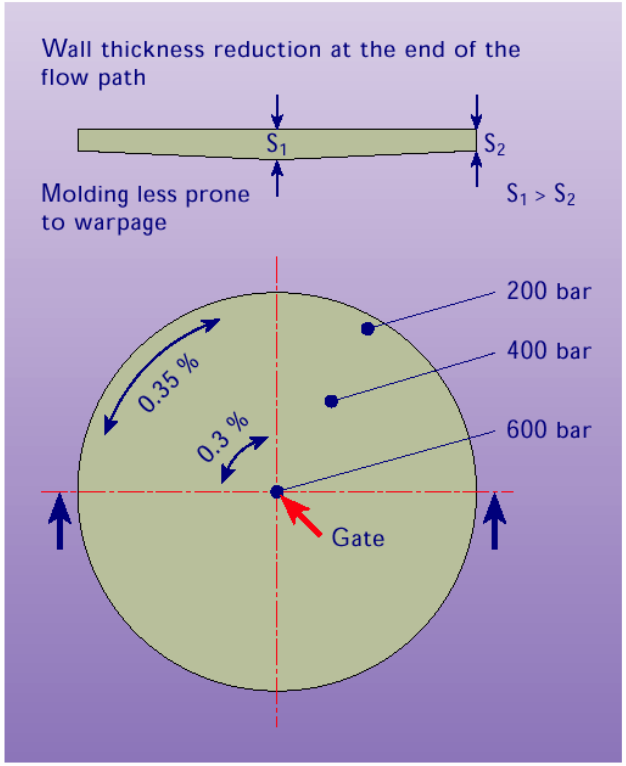
Good design

LANXESS

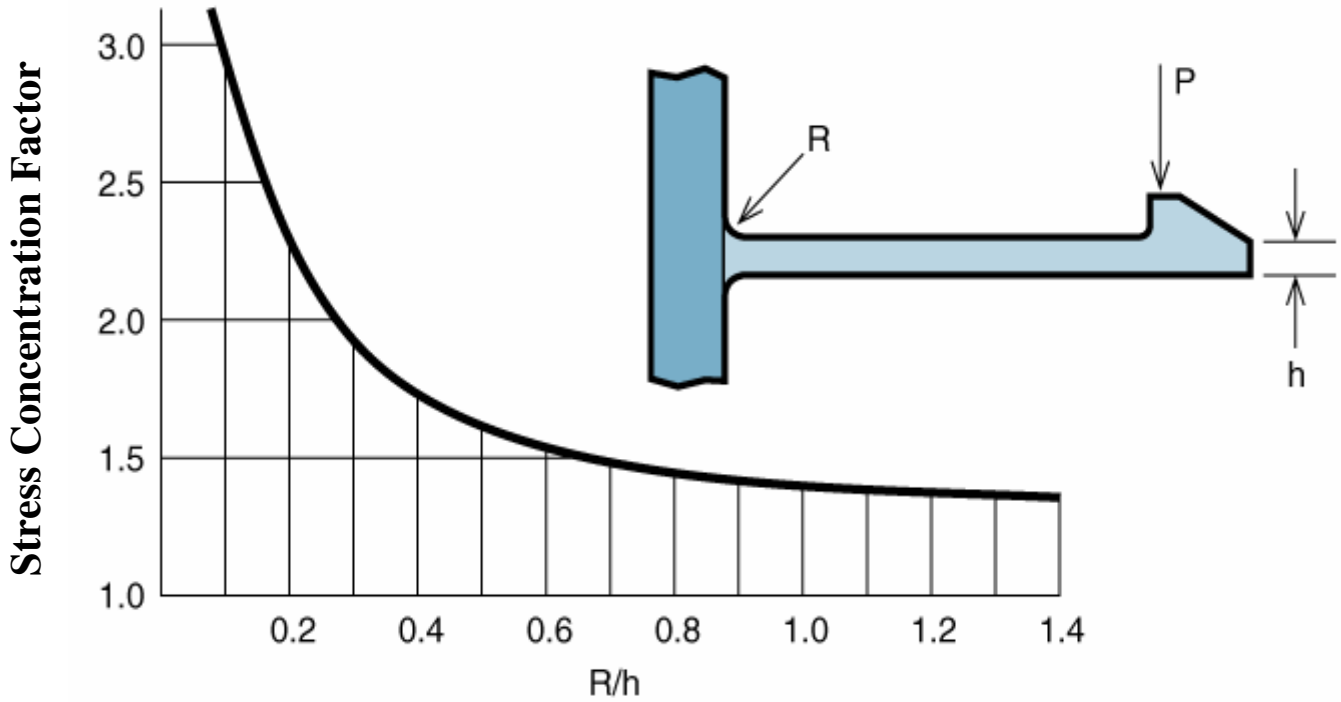
Injection/warpage

Warpage due to different pressure





Effect of sharp corner



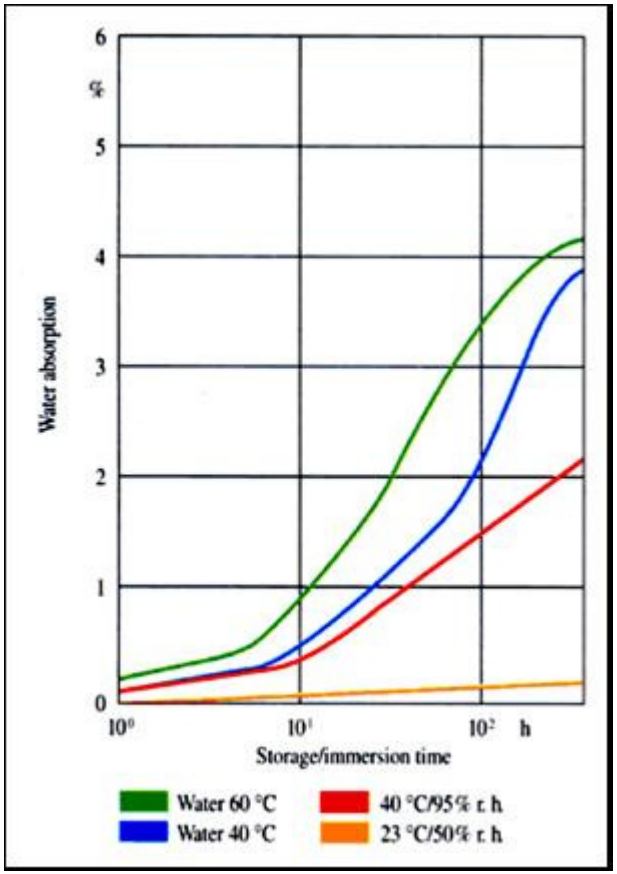
LANXESS

Secondary processing/conditioning

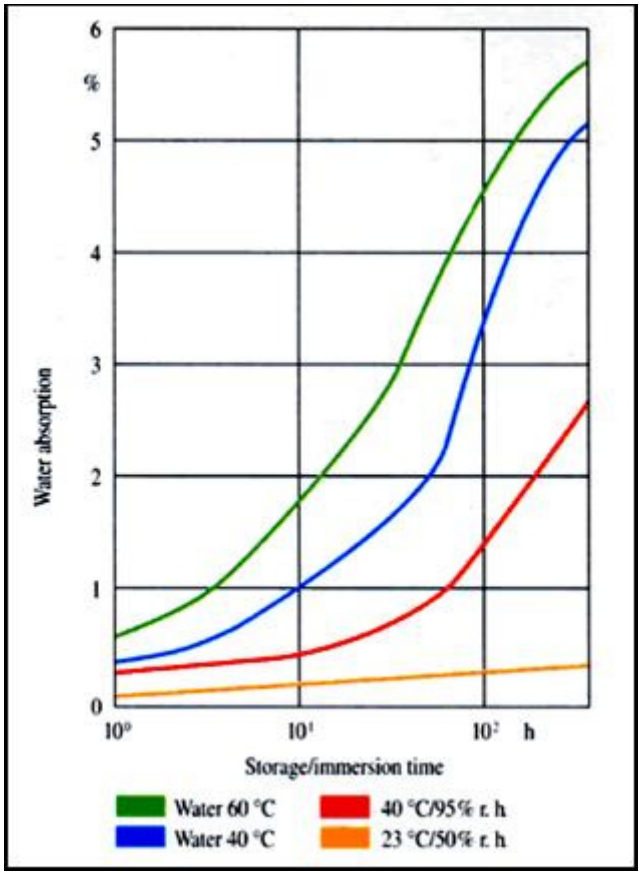
- Moisture absorption is a fundamental characteristic of Nylon. Absorption and losing of water is a reversible procedure.
- Crystallization degree will reduce the moisture content.
- Moisture content ↑, dimension ↑, toughness ↑, stiffness and strength ↓.

LANXESS

Conditioning time



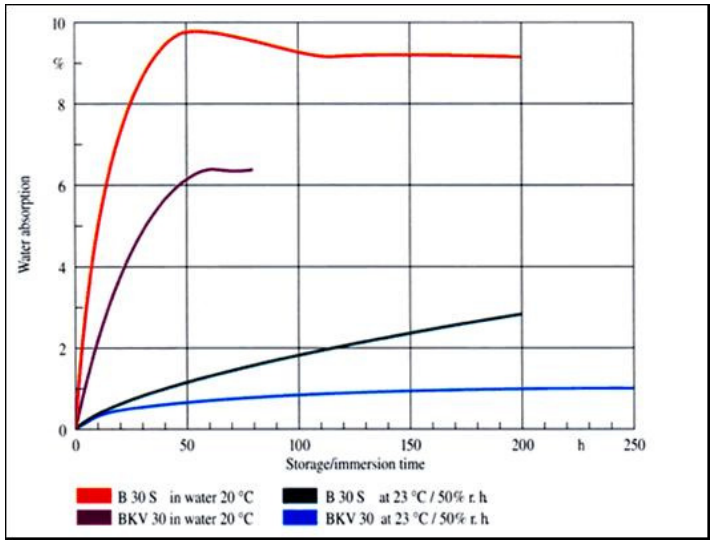
AKV

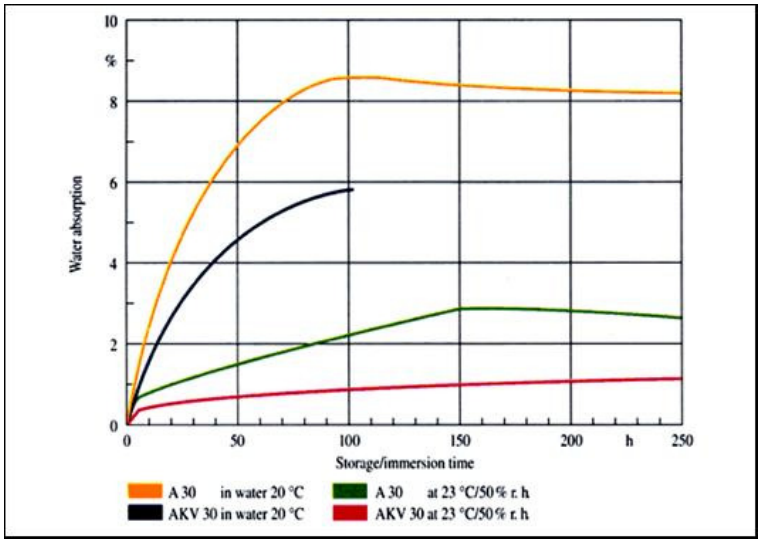


BKV

LANXESS

Conditioning time





Secondary processing/conditioning

Conditioning means:

- Immerse in water
- Immerse in vapor
- Spontaneous absorption in climate