ENGINEERING POLYMERS: THE 'TOP TEN' MOULDING PROBLEMS

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The ten problems listed below occur often when moulding semi-crystalline engineering polymers such as POM, PA, PBT and PET. In this series of articles the authors describe simple ways to identify and avoid them.

Chapter 1. Moisture in the granules

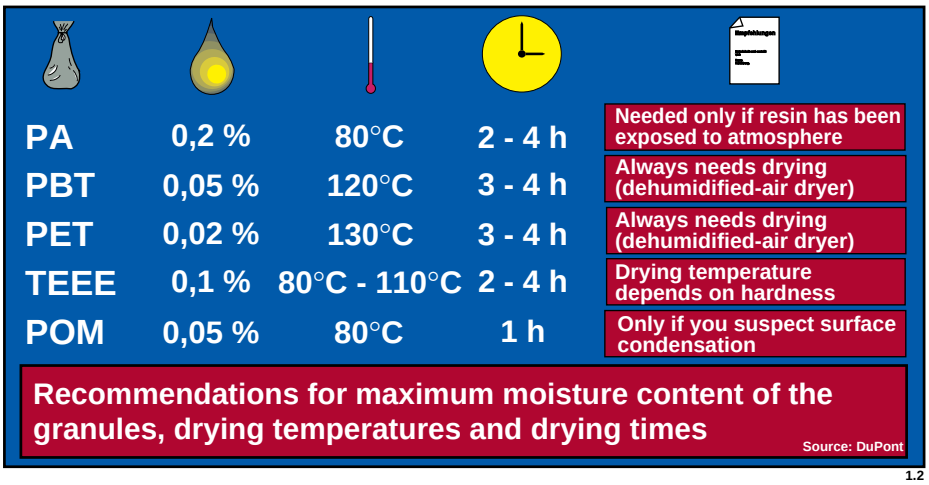
1. Moisture in the granules
2. Feed system too small
3. Wrong gate position
4. Hold time too short
5. Wrong melt temperature
6. Wrong tool temperature
7. Poor surface finish
8. Problems with hot runners
9. Warpage
10. Mould deposit

	Symptoms when moulding	Visible symptoms in moulded parts	Influence on mechanical properties
PA	• Drooling • Bubble formation in the purge	• Splaying in direction of flow • Increased formation of flash	• Lower impact and tensile strength
PET PBT	• No noticeable symptoms	• N.B.: Surface streaks (splaying) are not visible	• Much lower impact and tensile strength
POM	• Bubbles may be formed in the purge • Some mould deposit may be formed	• There may be splaying	• None
TEEE	• No noticeable symptoms	• Slightly increased tendency to form flash	• Lower impact and tensile strength

How to recognise excess moisture content Source: DuPont

1.1

Many plastics absorb moisture from the atmosphere; how much they absorb depends on the type of resin. Moisture in the granules, even if it is only surface condensation, can cause problems in parts moulded with engineering polymers. Many kinds of undesirable effects can occur, including processing problems, poor surface on moulded parts, or loss of mechanical properties. It is seldom possible to establish whether there is moisture present by means of visual examination alone. The authors prepared this article to give moulders who process a broad range of plastics some useful guidance on how to handle those polymers that are sensitive to moisture.



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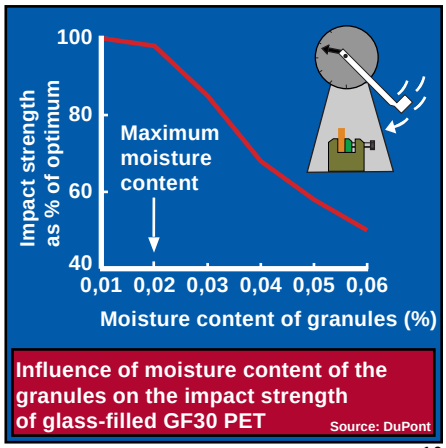


1.3

Drying Plastic Materials

Most engineering polymers require the moisture in the granules to be below a certain maximum level for processing. The need for drying depends mainly on how sensitive the raw material is to water. Naturally, the moisture content of the material as delivered, the type of packaging and the period of storage are also important criteria. For example, polyamide is generally packed in bags with a barrier layer of aluminium, so that it can be used straight out of the bag. However, most processors of PA prefer to dry the resin in any case, even though drying is not necessary if the material is used within one hour.

PET and PBT, on the other hand, are far more critical where moisture is concerned and must always be dried to ensure that impact strength of the moulded parts is not affected. Another factor is that these resins pick up moisture very rapidly after drying, so that moulders should exercise special care when handling open containers of PET and PBT, when they are in transport or conveyor systems, as well as regarding their dwell time in the hopper. Thus, in unfavourable climatic circumstances PET can absorb enough moisture in 10 minutes to exceed the maximum permitted moisture content for moulding of 0,02 per cent. Drying regrind and fully saturated granules (e.g. in the case of containers which were left standing around open) requires special care. In these cases the recommended drying times are usually not enough. Fully saturated polyamide may need more than 12 hours to dry. The yellowing associated with such treatment is practically unavoidable. The following guidelines should therefore be followed:

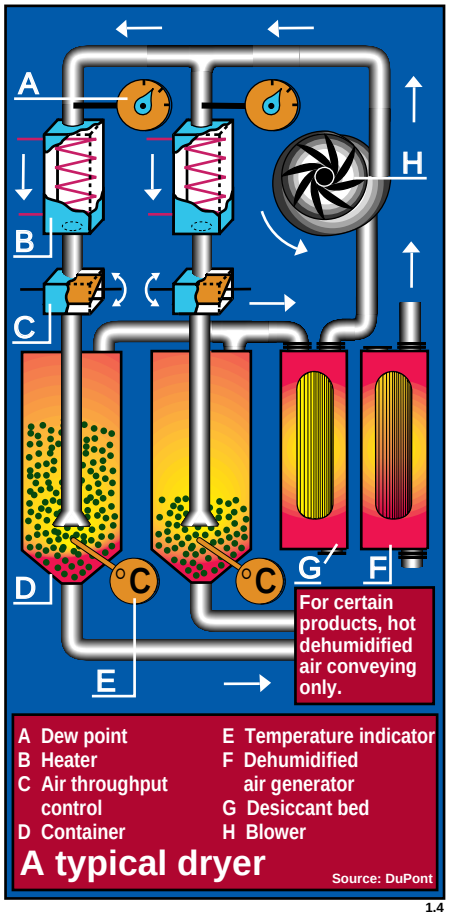
- Always store sprues and regrind in closed containers.
- Close containers or bags that have been partially used.
- Keep a lid on the hopper.

How to Dry

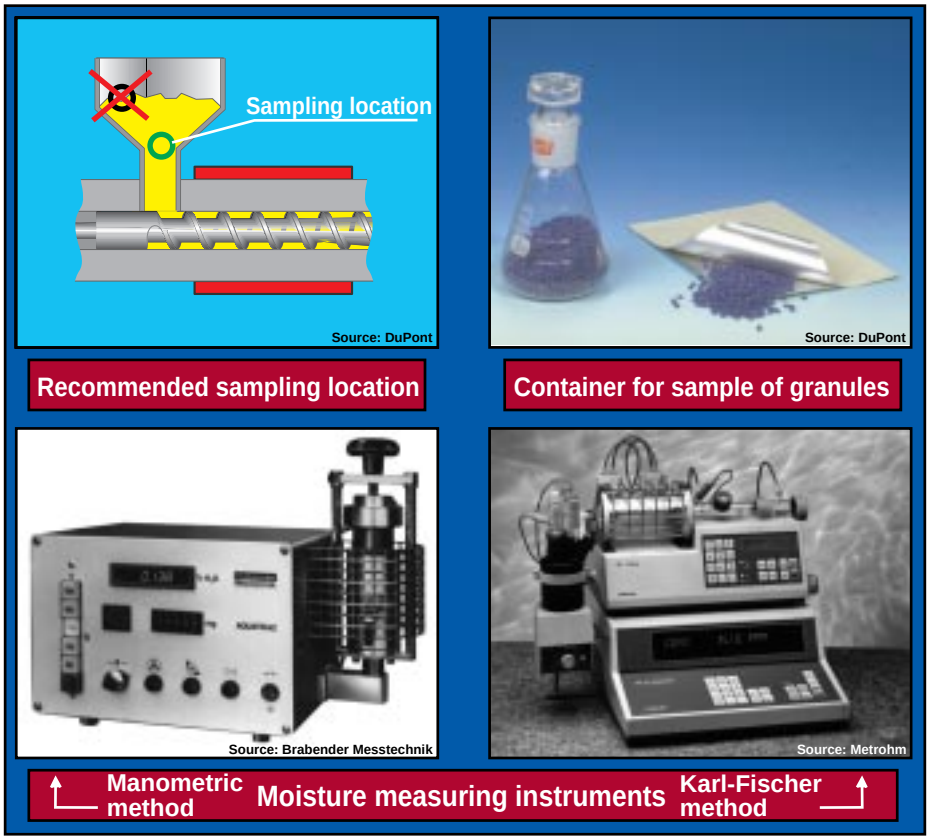
It is important to follow correct drying procedures if you want good quality mouldings. Simple hot air driers of various types are not adequate for drying polyesters, for example, but dehumidified-air drier systems are acceptable. Only these can provide the necessary constant and adequate drying, whatever the ambient climatic conditions may be. Apart from keeping the correct drying temperature, it is important to ensure that the dew point of the drying air remains lower than ≤–20° C. When operating multiple-container installations with different filling heights and bulk density, it is also important to ensure that the air throughput in each container is sufficient.

Measuring Moisture Content

Moisture in the granules can be measured with commercially available measuring instruments, e.g. with the manometric or the Karl-Fischer method. To eliminate sources of error, the sample should be taken from well down in the hopper, and should be sealed in an appropriate container. Special heat-sealable sachets coated with PE and aluminium are suitable, as well as laboratory-type glass containers that can be hermetically sealed.


A
B
C
D
E
F
G
H
C
C
For certain products, hot dehumidified air conveying only.
A Dew point
B Heater
C Air throughput control
D Container
E Temperature indicator
F Dehumidified air generator
G Desiccant bed
H Blower
A typical dryer
Source: DuPont

1.4


Sampling location
Source: DuPont
Recommended sampling location
Source: DuPont
Container for sample of granules
Source: Brabender Messtechnik
Source: Metrohm
Manometric method
Moisture measuring instruments
Karl-Fischer method

1.5