

Plastics — Determination of drawing characteristics of thermoplastics in the molten state

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National foreword

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Summary of pages

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Plastics — Determination of drawing characteristics of thermoplastics in the molten state

*Plastiques — Détermination des caractéristiques d'étirage des
thermoplastiques à l'état fondu*



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Foreword

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ISO 16790 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

Plastics — Determination of drawing characteristics of thermoplastics in the molten state

1 Scope

This International Standard specifies a method for determining the drawing and break characteristics of molten plastics. The method involves the measurement of the force generated in deforming a molten filament under defined extrusion temperature and drawing conditions.

Data is generated under non-isothermal and non-homogeneous deformation conditions. However, it is useful for the interpretation of polymer behaviour in extensional flow.

The method is suitable for thermoplastics moulding and extrusion materials that can be extruded using a capillary extrusion rheometer, or an extruder with capillary rod die or other extrusion devices, and have sufficient melt strength to be handled without difficulty.

Such materials should be chemically stable and produce a uniform extrudate free from heterogeneities, bubbles, unmelted impurities, etc.

This method may provide information on:

- processability for all extrusion techniques;
- the effect of mechanical and thermal history;
- the effect of chemical structure, such as branching, entanglements and molecular mass.

This technique is one of a number of techniques that can be used to measure the extensional flow behaviour of a material. This method of measurement does not necessarily reproduce the drawing conditions to which thermoplastics are subjected to during their processing.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 1133, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*

ISO 11443, *Plastics — Determination of the fluidity of plastics using capillary and slit-die rheometers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
drawing
process of stretching a filament of polymer melt that is being continuously formed by a capillary extrusion rheometer or extruder or other extrusion device

3.2
melt strength
 F_b
value of the melt tension at break of the extrudate.

NOTE 1 Also known as the force to break.

NOTE 2 It is expressed in newtons.

3.3
draw ratio at break
DR
ratio of the drawing velocity of the material at break to the mean velocity of the material flowing from the die

3.4
mean velocity
 v_m
average velocity of the extrudate at the die exit, determined as the ratio of volume flow rate to die cross-sectional area

NOTE It is expressed in metres per second.

3.5
initial diameter
 D_i
initial diameter of the extrudate after swelling on exiting from the die, the extrudate not yet having been subjected to significant drawing

NOTE 1 It is the maximum diameter the extrudate attains.

NOTE 2 It is expressed in metres.

NOTE 3 If no swelling of the extrudate occurs after exiting the die, the initial diameter is taken as the diameter of the die.

NOTE 4 This method may not be suitable for testing materials that do not exhibit swelling of the extrudate after exiting the die as such materials will be difficult to handle in drawing off and will exhibit small drawing forces.

3.6
initial velocity
 v_i
velocity of the extrudate near the die exit after swelling, the extrudate not yet having been subjected to significant drawing

NOTE 1 It is determined at the position of the initial diameter of the extrudate.

NOTE 2 It is expressed in metres per second.

3.7
drawing velocity
 v_t
velocity imposed on the lower end of the extrudate by the drawing unit

NOTE It is expressed in metres per second.