How long is the fibre?
How long is the fibre?

Testing method for the determination of the fibre length in long fibre reinforced plastic parts

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How long is the fibre?

Fibre reinforced plastics

successfully used in numerous industrial segments (automotive, aircraft etc.)

Fortifying a polymer with fibrous fillers

utilize the durability and stiffness of the fibre to improve quality of composite results in a significant increase of mechanical parameters (strength, stiffness etc.)

Matrix (polymer) is designated to surround the chopped strands in a force-fitting manner
How long is the fibre?

Production process

injection molding

Fibre materials

glass, carbon, steel, nature

Matrix polymers

Polypropylen, Polyamid, Polyoxyxymethylene, Polyester
How long is the fibre?

Long fibre – short fibre reinforced thermoplastics

Short fibre reinforced materials

chopped fibres

granules, size app. 3 mm

orientation of fibres while filling of mold leads to anisotropy and warpage
How long is the fibre?

Long fibre – short fibre reinforced thermoplastics

Long fibre reinforced materials

endless fibres

granules, size app. 10 mm

Fibre length is equal to granules length
How long is the fibre?

Long fibre – short fibre reinforced thermoplastics

Long fibre reinforced materials
less orientation while molding process, more like a grid

Seat bracket for German OEM

Part of seat bracket for German OEM after calcination
How long is the fibre?

To utilize the high durability of a fibre

length in a molded part must exceed the „critical fibre length”
lower fibre length can lead to failure „pull out”

Fibres are excessively and repeatedly stressed during the process of part production

results in fibre breakage

Length of fibre in the part must be monitored
Testing method for the determination of the fibre length

ISO 22314  International Standard published 2006

prescribes

Separation of fibres from the molded part
Dispersion of the total amount of fibres to an amount to be analyzed
Analysis of the fibre length and statistical report

polymerphys IK leads international project group for improving this standard
How long is the fibre?

„Area Of Interest“

Separation of the „AOI“ from the molded part without mechanical cutting

„AOI“ after calcination: undestroyed fibres in the boundary area
How long is the fibre?

Photographic image of short fibres

10 mm
How long is the fibre?

Photographic image of long fibres

10 mm
How long is the fibre?

<table>
<thead>
<tr>
<th>Faserlänge [mm]</th>
<th>anzahl gefunden Hij(t) [%]</th>
<th>zugetroffene Häufigkeit [%]</th>
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</table>

Mean fibre length $L_n = 0.60 \text{ mm}$

Example:

- Statistical Analysis
- Short fibres
- Mean fibre length
  
  $L_n = 0.60 \text{ mm}$
How long is the fibre?

**e.g.**
Statistical Analysis
Short fibres

Weighted Mean fibre length

$L_p$, 0.83 mm
How long is the fibre?

e.g.
Statistical Analysis
Long fibres

Mean fibre length

$L_n 0.9 \text{ mm}$
e.g.
Statistical Analysis
Long fibres

Weighted Mean fibre length

$L_p$ 2.1 mm
How long is the fibre?

Thank you

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