

# PA11 Carbon Fiber

## TECHNICAL DATA SHEET

# **| PA11 Carbon Fiber**

## **General description**

PA 11 Carbon Fiber is a bio-derived (castor oil) powder composite material based on Polyamide 11 enhanced with Carbon Fiber for better performance and rigidity. It features a high strength-to-weight ratio and high thermal properties. Its well-balanced profile of mechanical and thermal properties while maintaining good impact strength makes it one of the strongest and most versatile materials available on the powder market dedicated to SLS printing technology.

## **Features:**

- best tensile and flexural strength
- best thermal resistance
- good impact resistance
- high stiffness
- good elongation at break
- good surface quality
- good chemical resistance

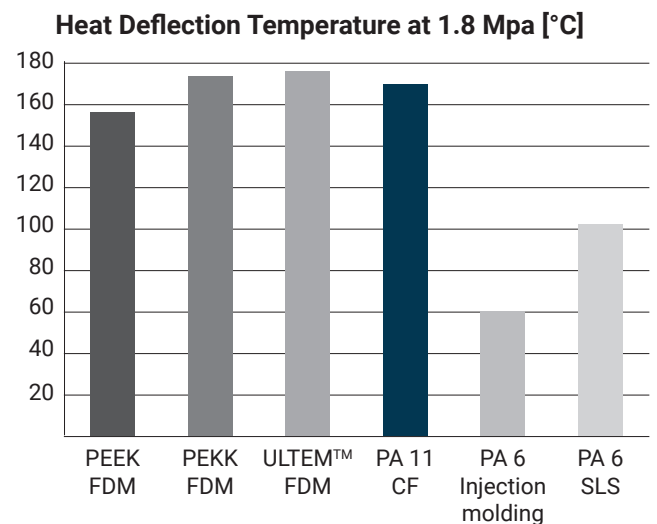
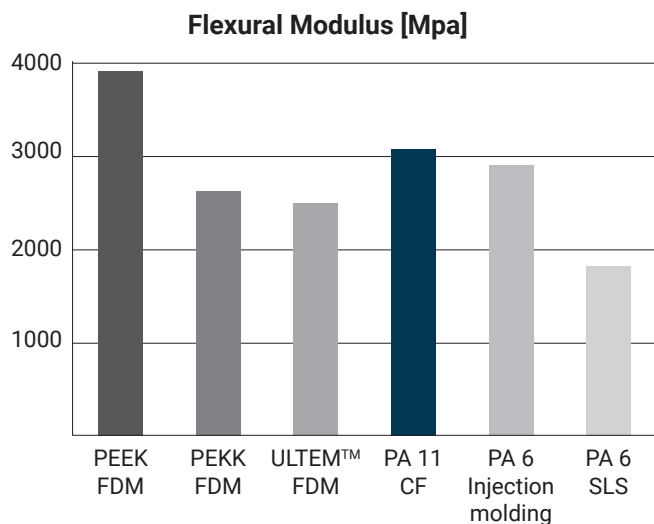
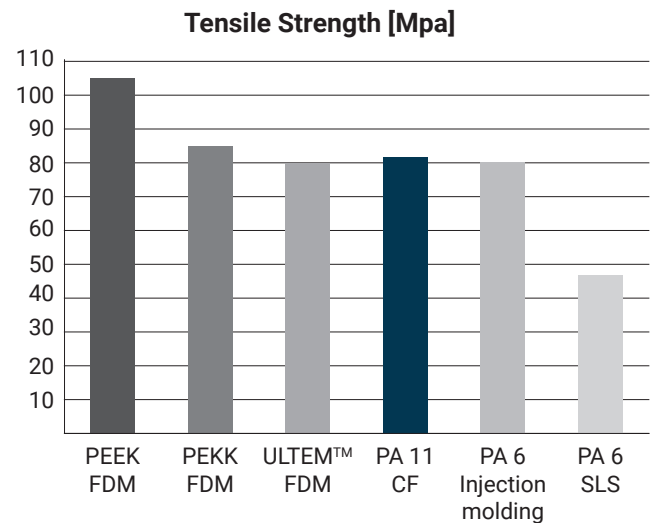
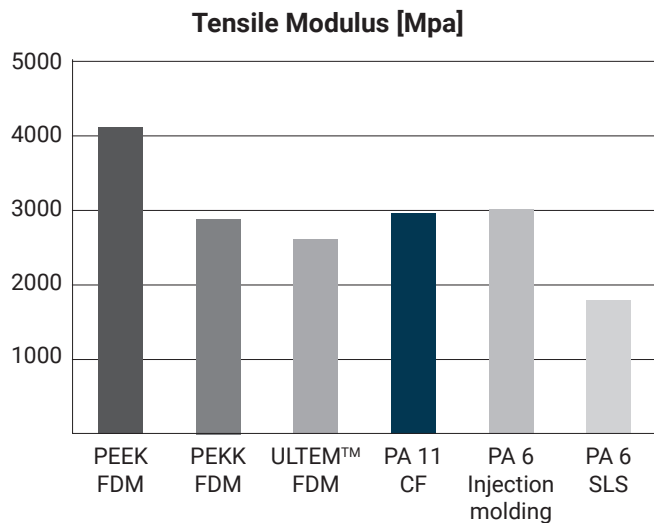
## **Applications:**

- automotive (high performance parts, metal replacement parts)
- universities/labs (mechanical, composites)
- extreme applications (motorsports, lightweight structures, temperature)
- maintenance and Repair
- medical - prosthesis
- aerospace models

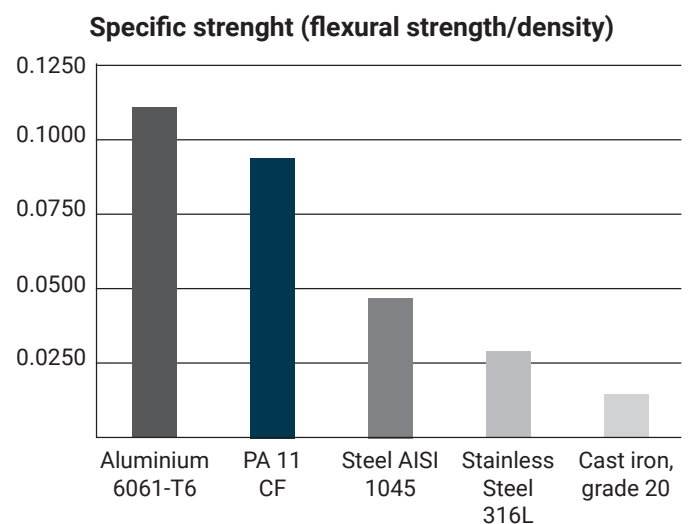
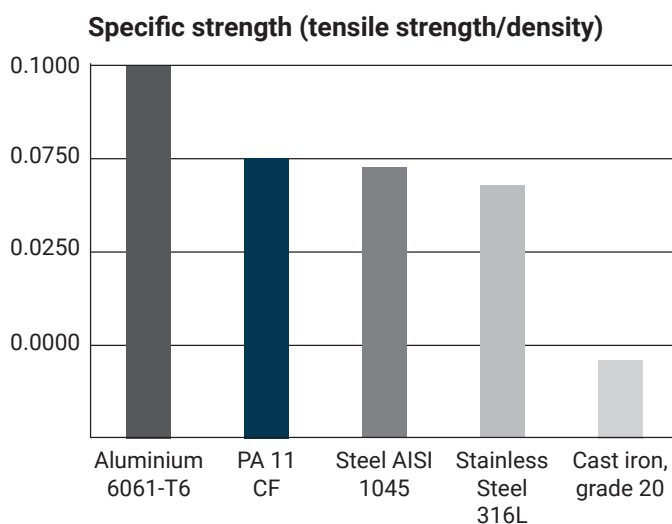


# PA11 Carbon Fiber

## Comparison to high-performance materials



## Comparison to metals



# PA11 Carbon Fiber

## General properties

## Test Method

|                            |                          |                   |                    |
|----------------------------|--------------------------|-------------------|--------------------|
| Dedicated for              | Lisa X                   |                   |                    |
| Software                   | Sinterit Studio Advanced |                   |                    |
| Nitrogen needed            | Yes                      |                   |                    |
| Colour                     | black                    |                   |                    |
| Refresh ratio <sup>1</sup> | 40                       | %                 |                    |
| Bulk density               | 540                      | kg/m <sup>3</sup> | PN-EN ISO 60:2010  |
| Printout density           | 1.09                     | g/cm <sup>3</sup> | PN-EN ISO 845:2010 |
| Printout water absorption  | 0.86                     | %                 | PN-EN ISO 62:2008  |

## Thermal properties

## Test Method

|                                           |     |    |                                              |
|-------------------------------------------|-----|----|----------------------------------------------|
| Melting temperature                       | 197 | °C | PN-EN ISO 11357                              |
| Heat Deflection Temperature A at 1.8 MPa  | 170 | °C | PN-EN ISO 75-2:2013-06 / PN-EN ISO 75-2:1998 |
| Heat Deflection Temperature B at 0.45 MPa | 191 | °C | PN-EN ISO 75-2:2013-06 / PN-EN ISO 75-2:1998 |

## Mechanical properties

## Test Method

|                                                   |        |                   |                      |
|---------------------------------------------------|--------|-------------------|----------------------|
| Flexural Strength (X direction)                   | 100    | MPa               | PN-EN ISO 178:2019   |
| Flexural Modulus (X direction)                    | 3050   | MPa               | PN-EN ISO 178:2019   |
| Flexural Strength (Z direction)                   | 66.1   | MPa               | PN-EN ISO 178:2019   |
| Flexural Modulus (Z direction)                    | 1420   | MPa               | PN-EN ISO 178:2019   |
| Tensile Strength (X direction)                    | 81     | MPa               | PN-EN ISO 527-1:2012 |
| Tensile Modulus (X direction)                     | 2950   | MPa               | PN-EN ISO 527-1:2012 |
| Elongation at Break (X direction)                 | 24.5   | %                 | PN-EN ISO 527-1:2012 |
| Tensile Strength (Z direction)                    | 47.3   | MPa               | PN-EN ISO 527-1:2012 |
| Tensile Modulus (Z direction)                     | 1490   | MPa               | PN-EN ISO 527-1:2012 |
| Elongation at Break (Z direction)                 | 17.9   | %                 | PN-EN ISO 527-1:2012 |
| Impact Strength (Charpy - unnotched)              | 113.65 | kJ/m <sup>2</sup> | PN-EN ISO 179-1:2010 |
| Shore Hardness in scale                           | D81    |                   | PN-EN ISO 868:2005   |
| Storage Modulus (X direction) @23 °C <sup>2</sup> | 4575   | MPa               | PN-EN ISO 6721       |
| Loss Modulus (X direction) @23 °C <sup>2</sup>    | 172    | MPa               | PN-EN ISO 6721       |
| Storage Modulus (Z direction) @23 °C <sup>2</sup> | 3418   | MPa               | PN-EN ISO 6721       |
| Loss Modulus (Z direction) @23 °C <sup>2</sup>    | 105    | MPa               | PN-EN ISO 6721       |

1. Refresh ratio is the amount of refreshing powder that is required to be mixed after the printing with unsintered material.

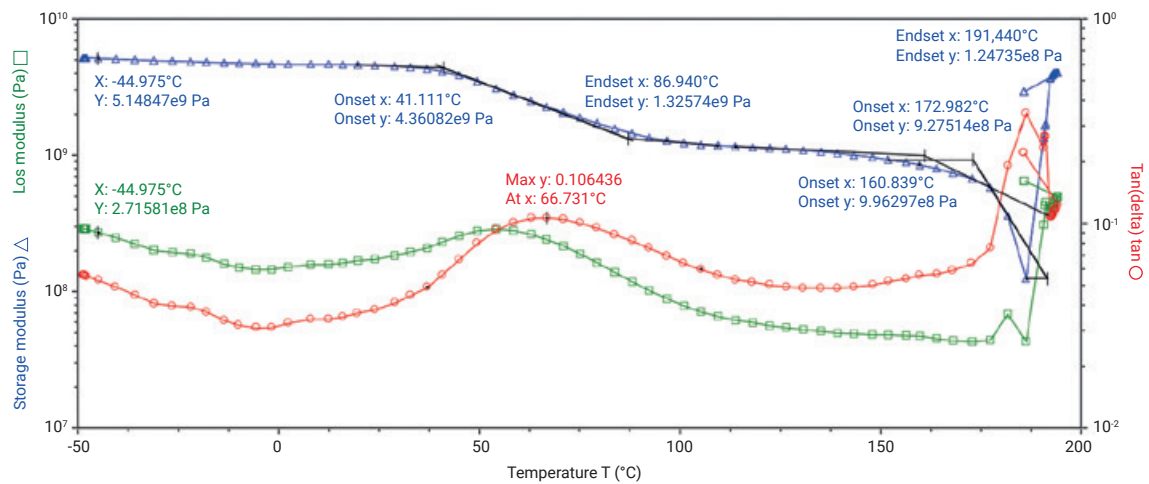
2. Based on Dynamic mechanical analysis with amplitude 50µm, frequency 10Hz, initial force: 10N.

Information provided within this document are average values for reference and comparison only. All tests were performed with print samples from Lisa/Lisa Pro printers. Parameters presented in this specification are subject to change. Final part properties may vary based on printed part design and print orientation. All mechanical tests were carried out on samples conditioned to ISO standards only, at (23±2)°C and (50±5)% r. h.

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## Dynamic Mechanical Analysis (X axis)

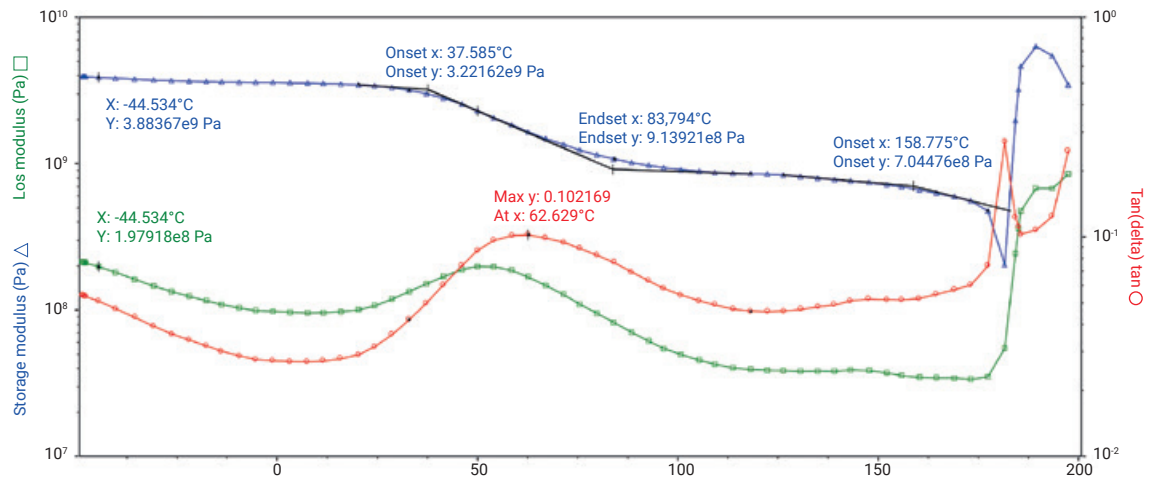
Flexural test: amplitude 50  $\mu\text{m}$ , frequency 10 Hz, initial force: 10 N



|                       | Range 1<br>(glassy region) |        | Range 2<br>(glass transition region) |        |        | Range 3<br>(rubbery plateau) |         |
|-----------------------|----------------------------|--------|--------------------------------------|--------|--------|------------------------------|---------|
| Temperature [°C]      | -44.975                    | 41.111 | 41.111                               | 54.180 | 86.940 | 86.940                       | 160.839 |
| Storage Modulus [MPa] | 5148                       | 4361   | 4361                                 | 3105   | 1326   | 1326                         | 996     |
| Loss Modulus [MPa]    | 271                        | 233    | 233                                  | 287    | 124    | 124                          | 47      |

## Dynamic Mechanical Analysis (Z axis)

Flexural test: amplitude 50  $\mu\text{m}$ , frequency 10 Hz, initial force: 10 N



|                       | Range 1<br>(glassy region) |        | Range 2<br>(glass transition region) |        |        | Range 3<br>(rubbery plateau) |         |
|-----------------------|----------------------------|--------|--------------------------------------|--------|--------|------------------------------|---------|
| Temperature [°C]      | -44.534                    | 37.585 | 37.585                               | 54.180 | 83.794 | 86.940                       | 158.775 |
| Storage Modulus [MPa] | 3884                       | 3222   | 3222                                 | 2292   | 914    | 914                          | 705     |
| Loss Modulus [MPa]    | 198                        | 152    | 152                                  | 199    | 83     | 83                           | 35      |

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