# nPower

nPower is based on on a Polyphenylene sulfide (PPS) blend.

It's a semicrystalline material, with excellent chemical resistance (can handle strong acid/basis and hydrocarbons). It can be considered an alternative to PEEK when very high mechanical or thermal properties are not required.

It can be consider as inherently UL-94 compliant.

## *Suggested use*

| | |
|---|---|
| Automotive | |
| Chemical | |
| Oil & Gas | |
| Nuclear | |
| ESD Parts | |

## *Compatibilities*

| | |
|---|---|
| **Support compatibility** | SSU05 (Break-Away) |
| | SSU09 (Soluble with WAVE Powder[1]) |
| **Material compatibility** | ELASTO HT |
| | |
| | |
| | |
| | |

[1] SSU09 support is degradable with an alkaline solution obtained by WAVE powder; the proportion of 170 g of powder per 7 liters of water is recommended. We also recommend to use ultrasonic tank and water at 70 °C.

## Easy profiles suggested

| Layer | Ø 0.3 mm | Ø 0.4 mm | Ø 0.6mm | Ø 0.8 mm |
|---|---|---|---|---|
| **0.10** | * | | | |
| **0.15** | ** | * | | |
| **0.20** | * | ** | ** | |
| **0.25** | | ** | ** | |
| **0.30** | | * | ** | * |
| **0.40** | | | * | ** |
| **0.50** | | | | * |

** : Recommended
* : Discrete quality

## Before printing

| | |
|---|---|
| **Drying** | Gentle drying (55 °C) before and during the job is recommended |
| **Cleaning** | It's suggested to clean the bed with IPA before print |
| **Print directly on Veltra bed** | Feasible but brim is recommended |
| **Extruder** | HI-TEMP |
| **Nozzle** | Standard |
| **SPFU** | Not compatible |

## General advice

In the case of supported parts, it is suggested to inflate supports to increase the adhesion and ensure the reliability of the job.

Large objects and/or with high infill percentages printed with NP Carbon, can present deformation and warping. For this reason, brim and inflate support are suggested.

## *Physical properties**

| Propriety | Symbol | Standard | Value |
|---|---|---|---|
| **Density** | $\rho$ | ISO 1183-1 | 1.26 g/cm$^3$ |
| **Water absorption** | $w_w$ | N.A. | |

## *Thermal properties**

| Propriety | Symbol | Standard | Value |
|---|---|---|---|
| **Melting flow index** | M. F. I. | ISO 1133 | N/A |
| **Glass transition temperature** | $T_g$ | // | N/A |
| **Temperature deflection under load** | $HDT_{1.8}$ | ASTM D648 (unannealed) | 105 °C |
| **Cold crystallization temperature** | $T_{cc}$ | ISO 11357 | 123 °C |
| **Coefficient of linear thermal expansion** | $\alpha$ | ISO 11359 | N/A |
| **Flammability** | | UL94 | V0 |

## *Electrical properties**

| Propriety | Symbol | Standard | Value |
|---|---|---|---|
| **Surface resistivity** | $\sigma_e$ | N/A | N/A. |
| **Electric strength** | $E_B$ | N/A | N/A. |

* values provided by polymer supplier

## *Mechanical properties*

Based on layer-by-layer deposition, additively manufactured parts, especially with the FDM technique, present a not negligible anisotropy on mechanical properties.

The user must think about the correct displacement of the part in the machine for maximize its mechanical properties.

For this reason, we report the mechanical properties of our specimens considering the three main orientations, by plane x-y (flat), by plane y-z (on edge), and by plane z-x (upright).

All specimens are made with the same printing conditions:

- Infill: 100%
- Nozzle: 0,4 mm
- Layer thickness: 0.2 mm
- Raster angle: 45 °

For more information about the test and specimens' conditions, we suggest checking the ISO references that are reported in the following tables.

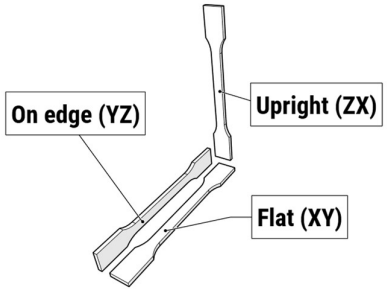



*Figure 1: specimen displacement to determine tensile properties (ref. ISO 527-2)*

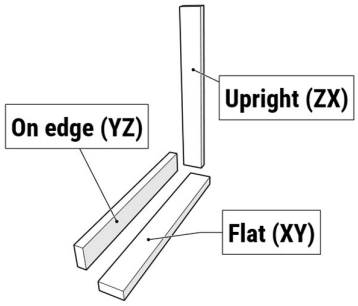
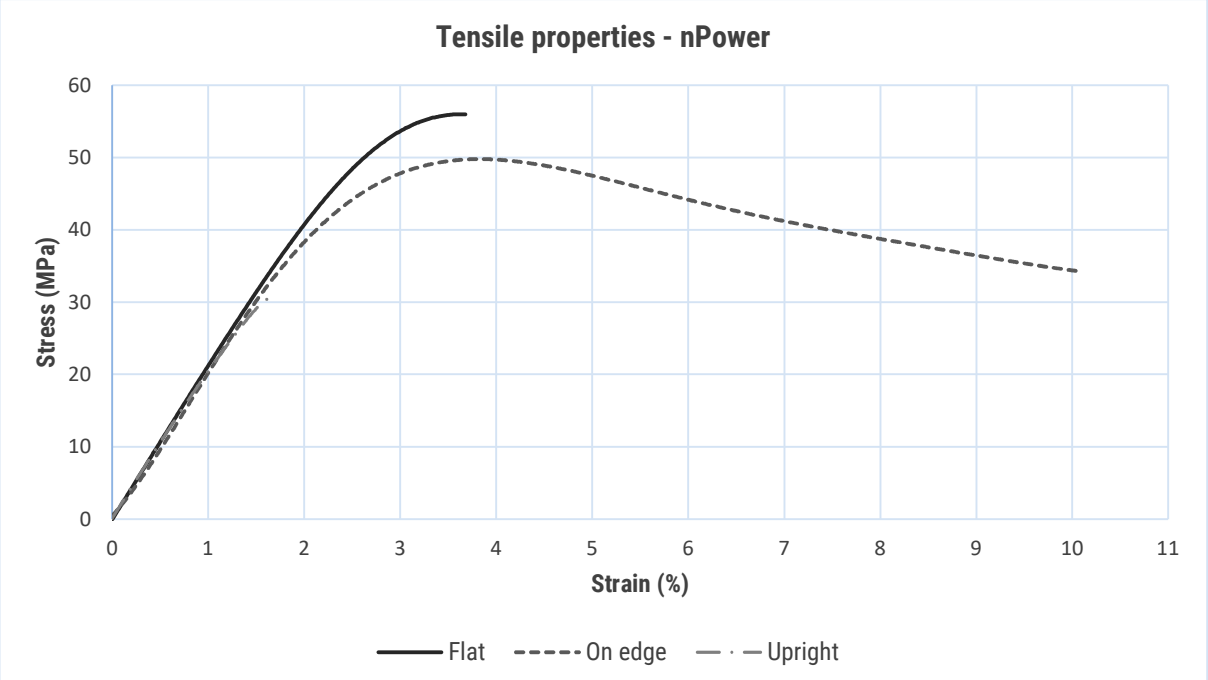



*Figure 2: specimen displacement to determine flexural and impact properties (ref. ISO 178 and 179-1)*

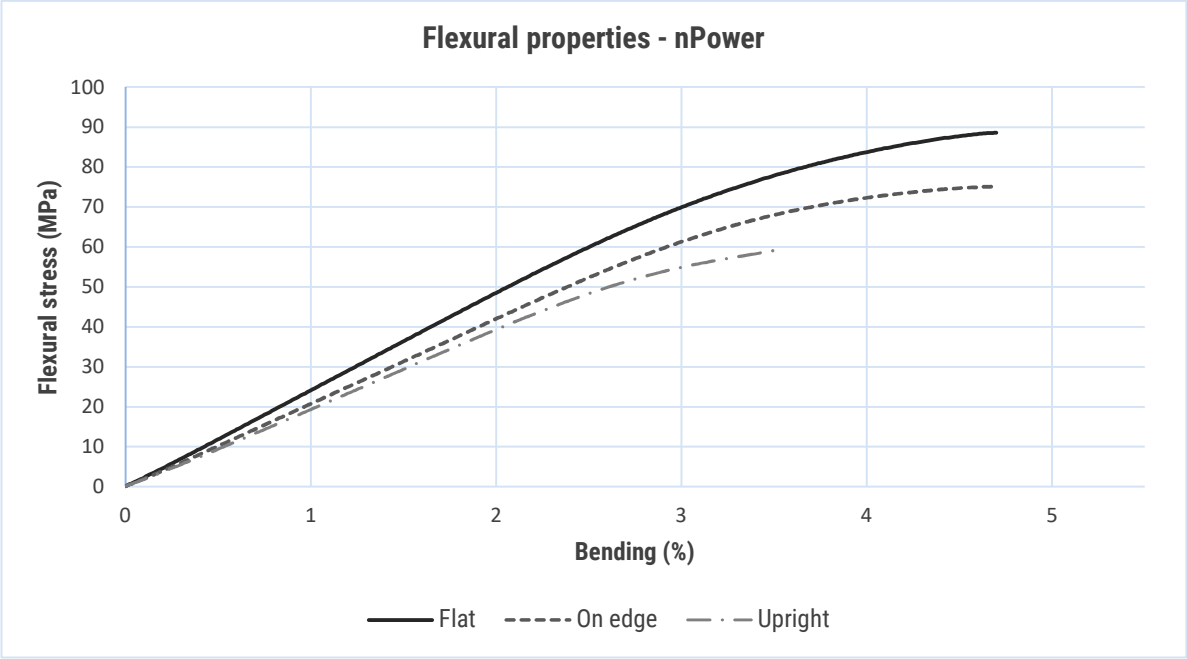
## *Tensile properties*

| Propriety | Symbol | Standard | Specimens build direction | Value |
|---|---|---|---|---|
| **Tensile modulus** | $E_t$ | ISO 527-2 | Flat | 2112 MPa |
| | | | On edge | 2014 MPa |
| | | | Upright | 2113 MPa |
| **Yield stress** | $\sigma_y$ | | Flat | 56 MPa |
| | | | On Edge | 50 MPa |
| | | | Upright | No yield |
| **Yield strain** | $\varepsilon_y$ | | Flat | 6.2 % |
| | | | On Edge | 6.5 % |
| | | | Upright | No yield |
| **Strength at break** | $\sigma_b$ | | Flat | 56 MPa |
| | | | On Edge | 52 MPa |
| | | | Upright | 53 MPa |
| **Strain at break** | $\varepsilon_b$ | | Flat | 3.7 % |
| | | | On Edge | 10.1 % |
| | | | Upright | 2.5 |



## *Flexural properties*

| Propriety | Symbol | Standard | Specimens build direction | Value |
|---|---|---|---|---|
| **Flexural modulus** | $E_f$ | ISO 178 | Flat | 2321 MPa |
| | | | On edge | 1965 MPa |
| | | | Upright | 1835 MPa |
| **Flexural strength** | $\sigma_{fC}$ | | Flat | 78 MPa |
| | | | On Edge | 68 MPa |
| | | | Upright | 56[2] MPa |




## *Impact properties*

| Propriety | Symbol | Standard | Specimens build direction | Value |
|---|---|---|---|---|
| **Charpy unnotched impact strength** | $a_{cu}$ | ISO 179 | Flat | 96 kJ/m$^2$ |
| | | | On edge | 86 kJ/m$^2$ |
| | | | Upright | 8 kJ/m$^2$ |
| **Type of failure** | ToF | | Flat | No break |
| | | | On Edge | No break |
| | | | Upright | Comp. break |

[2] This value represent the flexural stress at break, reached at 3.3 % of bending.

## The fine print

The information and values listed into this document are provided in good faith, based on specimens printed with 3ntr machines according to the latest version of SSI print parameters valid at the date of issuance.

3ntr provides you with this information for your guidance to select the correct polymer and setup but user is responsible for determining that 3ntr material is safe, technically correct and legal for the selected application.

The values listed in this documents are not meant for design specification or quality control guidelines: is it user responsibility to design parts with appropriate safety margins to comply with any material variation due part design, production, test conditions, use conditions.

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