uDiamond®

Date: 13-06-2019

Nanodiamond Reinforced PLA 3D Filament

Carbodeon PLA + uDiamond Filament is a high-performance diamond enhanced 3D printing filament. It contains functionalized nanodiamond particles. Nanodiamonds are spherical and act as lubricant in the filament extrusion, causing no increase in nozzle wear. This means you can print this material with standard brass nozzles, unlike other carbon-reinforced materials. The enhanced thermal conductivity of the material enables significantly faster printing speeds (up to 500mm/s, depending on your 3D printer's capabilities).

The diamond particles also reinforce the polymer structure, improving the stiffness, strength and adhesion between printed layers. The material also has a significantly higher temperature resistance than standard PLA, with a heat deflection temperature of 107C (125C for annealed components). The filament is suitable for consumer-grade and professional FDM/FFF 3D printers. The unique combination of stiffness, strength, wear resistance and unique thermal features makes it an excellent choice for functional mechanical prints. The stiffness of this material is equal to that of carbon fiber reinforced Nylon but is significantly easier to print and a cheaper alternative.

The printed item layer structure is less pronounced than in other PLA material and the printed components are easy to sand.

The recommended printing temperature is 220-250 °C (with certain tools up to 270 °C) and is dependent on printing speed.

uDiamond® PLA 3D filament can also be printed without a heated bed.

uDiamond® PLA 3D filaments are available in both 1,75 mm and 2,85 mm diameters, in sizes 1 kg and 2.3 kg's.

Available colors: natural; black and iron grey.

Carbodeon
SUPERHARD NANOMATERIALS

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Nanodiamond reinforced PLA filament physical properties:

Property	Test Method	Typical Value
Density (g/cm^3, at RT)	ISO 1183	1,35
Glass transition temperature (°C)	DSC, 10 °C/min	49,7-55,2
Moisture content*	Thermogravimetric	≤ 0,1 wt.%
Melting temperature (°C)	DSC	171,6-182
Odor	/	Almost odorless
Solubility	/	Insoluble in water
HDT B, 0.45 Mpa, flatwise (°C)	ISO 75	107,2
HDT B, 0.45 MPa, flatwise, annealed (°C)	ISO 75	125,1
Thermal conductivity (W/m•K)	Hot disk method	0,38

- For newly opened product. If 24 hours in controlled environment, the filament moisture will elevate to ≤ 0,15 wt.%. Subsequent drying for 20 h at 50 °C will reduce the moisture into ≤ 0,02 wt.%. The compound physical properties have been analyzed by VTT, Finland.

Nanodiamond reinforced PLA filament mechanical properties:

Property	Test Method	Typical Value
Young's Modulus (MPa)	ISO 527	6300
Tensile strength (MPa), at max load	ISO 527	43,5
Elongation at Break (%)	ISO 527	3,2
Bending Modulus (MPa)	ISO 178	5446
Bending Strength (MPa)	ISO 178	80.3
Impact strength (kJ/m^2)	ISO 179	2.5
Impact strength (kJ/m^2, Scharpy notched 23°C)	ISO 179	2.2

All testing specimens were printed by Mass Portal, using Mass Portal Pharaoh XD20 (SN: 150633) under the following conditions: printing temperature = 270 °C, printing speed = 60 mm/s, heat bed temperature 30 °C.

The compound physical properties have been analyzed by VTT, Finland.

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