

TECHNICAL DATA SHEET TPU POLYMER Thermoplastic Polyurethanes

MANUFACTURER

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The manufacturer of the original polymer without nanoreinforcement is Covestro Deutschland AG.

BIOCOMPABILITY

The original polymer meets the requirements of the FDA-modified ISO 10993, Part 1 "Biological Evaluation of Medical Devices" tests with human tissue contact time of 30 days or less and has been tested according to certain tests under ISO 10993-1.

Tests performed on the polymer: Physicochemical Test for Plastics, Metals Analysis by ICP, Citotoxicity - MEM Elution (ISO 10993-5), Sensitization - Kligman Maximisation (ISO 10993-10), Irritation - Intracutaneous Injection (ISO 10993-10), Material-Mediated Rabbit Pyrogen Test (ISO 10993-11), Hemolysis - Rabbit Blood (ISO 10993-4), Genotoxicity - Ames Reverse Mutation (ISO 10993-3) and Intramuscular Implantation (ISO 10993-6).

ANTIMICROBIAL EFFECT

The antimicrobial effect of graphene-based materials has been widely demonstrated in various investigations. The graphene oxide and the graphene nanofiber are safe and has a high purity, in terms of contaminants such as sulfates or metals (such as iron or manganese), all of which have concentrations below <0,1%.

The main mechanism of this effect is based to generate reactive oxygen species (ROS) agents such as H₂O₂, OH⁻, and O₂ capable of destroying the respiratory system of microorganism and specifically attacks the lipid membrane of the coronavirus.

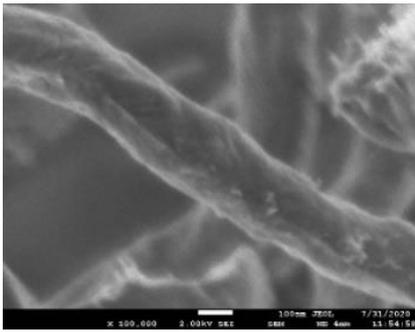
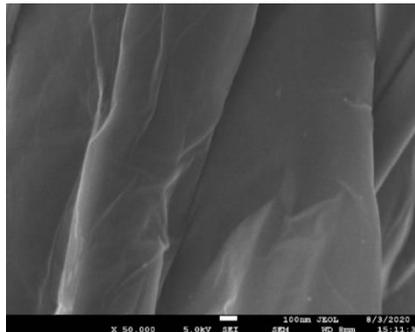
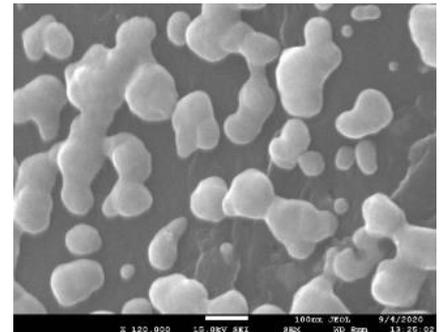
Material properties	ISO	TPU (original)	NEO TPU (GNF)	ABV TPU (GO-Ag)
Specific Gravity (g/cc)		1,17	1,19	1,17
Hardness, Shore D		65	64	64
Taber Abrasion (mg loss)		75	-	-
Colour/Clarity		Clear	Black	Light Black

**Mechanical properties
(ISO Data)**

	ISO	TPU (Original)	NEO TPU (GNF)	ABV TPU (GO-Ag)
Tensile Strength (MPa)	ISO 527	57,40	52,10	43,81
Tensile Modulus (Mpa)	ISO 527	25,67	15,45	11,5
Elongation at Yield (%)	ISO 527	2,60	3,57	3,87
Elongation at break (%)	ISO 527	176,14	241,78	248,00
Flex modulus (Mpa)	ISO 527	420,6	768,94	502,13

**Other properties
(3D Printing)**

	ISO	TPU (Original)	NEO TPU (GNF)	ABV TPU (GO-Ag)
Melt temperature (°C)		195-215	196-205	195-215
Bed temperature (°C)		50-70	50-70	60-70
Velocity (mm/s)		20-40	20-40	20-40
Softening temperature, Vicat (°C)	ISO 306 (A120)	138	122	-

Scanning Electron Microscope (SEM)**Graphene Nanofiber (GNF)****Graphene Oxide (GO)****Graphene Oxide-AgNp****Test performed on 3D printed specimen**

Upper and lower layer	3+3
Intermediate layer	3
Filling	100%
Tensile Tester Specimen UNE EN ISO 527	1BA
Flexural Test Specimen UNE EN ISO 168 (mm)	80x10x4

The values in this data sheet may change depending on printing conditions, part design or environmental conditions.