Density of Plastics: Technical Properties

Density measures the **mass per unit volume**. It is calculated by dividing the mass of the material by the volume and is normally expressed in g/cm^3.

The **density of a plastic** sample may change due to change in crystallinity, loss of plasticizers, absorption of solvent, etc. It is important to note that *density varies with temperature*.

Therefore, to determine the exact density of plastic, it is important to:

- Identify the Material
- Follow the physical changes in the sample
- Indicate the uniformity among different sampling specimens
- Indicate the average density of a large item, and
- Calculate the strength weight and cost-weight ratios

Density can be converted to **specific gravity** by dividing the Density value (in g/cm^3) by 0.9975.

***Check out more on density**:*

- Density Values of Several Plastics
- How to Calculate the Density of Plastic

How to Calculate the Density of Plastic

The density of any substance or object can be found in the same way: divide the total mass of the object by the total volume of the object. Although you might need to use different methods to find the volume or the mass of different substances, you would calculate the density in the same way using this formula:

The most usual test methods to determine plastics Density are (of course there exist several other methods as well, but they are not discussed here):

- ASTM D1505
- ASTM D792 - 98
- ISO 1183-2

ASTM D1505

ASTM D1505 determines Density of a material by the density-gradient technique. A material is placed in a liquid column of variable density with standard floats (glass beads of known density). The density of the material is then calculated based on its relative position to the floats in the column and the densities of the glass beads.

ASTM D792 - 98

ASTM D792 - 98 describes the determination of the specific gravity (relative density) and density of solid plastics in forms such as sheets, rods, tubes, or molded items. There are chiefly two test methods are involved:

» Test Method A--For testing solid plastics in water, and
» Test Method B--For testing solid plastics in liquids other than water

ISO 1183-2

The method specifies a gradient column method for the determination of the density of non-cellular moulded or extruded plastics in void-free form. Density gradient columns are columns containing a mixture of two liquids, the density in the column increasing uniformly from top to bottom.

Density Values of Several Plastics

Polymer Name	Min Value (g/cm^3)	Max Value (g/cm^3)
ABS - Acrylonitrile Butadiene Styrene	1.020	1.210
ABS Flame Retardant	1.150	1.200
ABS High Heat	1.100	1.150
ABS High Impact	1.000	1.100
ABS/PC Blend - Acrylonitrile Butadiene Styrene/Polycarbonate Blend	1.100	1.150
ABS/PC Blend 20% Glass Fiber	1.250	1.250
ABS/PC Flame Retardant	1.170	1.190

Amorphous TPI Blend, Ultra-high heat, Chemical Resistant (High Flow)	1.370	1.370
Amorphous TPI Blend, Ultra-high heat, Chemical Resistant (Standard Flow)	1.370	1.370
Amorphous TPI, High Heat, High Flow, Lead-Free Solderable, 30% GF	1.520	1.520
Amorphous TPI, High Heat, High Flow, Transparent, Lead-Free Solderable (High Flow)	1.310	1.310
Amorphous TPI, High Heat, High Flow, Transparent, Lead-Free Solderable (Standard Flow)	1.310	1.310
Amorphous TPI, Highest Heat, Chemical Resistant, 260C UL RTI	1.420	1.420
Amorphous TPI, Moderate Heat, Transparent	1.300	1.300
Amorphous TPI, Moderate Heat, Transparent (Food Contact Approved)	1.300	1.300
Amorphous TPI, Moderate Heat, Transparent (Mold Release grade)	1.300	1.300
Amorphous TPI, Moderate Heat, Transparent (Powder form)	1.300	1.300
ASA - Acrylonitrile Styrene Acrylate	1.050	1.070
ASA/PC Blend - Acrylonitrile Styrene Acrylate/Polycarbonate Blend	1.150	1.150
ASA/PC Flame Retardant	1.250	1.250
ASA/PVC Blend - Acrylonitrile Styrene Acrylate/Polyvinyl Chloride Blend	1.200	1.200
CA - Cellulose Acetate	1.220	1.340
CAB - Cellulose Acetate Butyrate	1.150	1.220
Celllulose Diacetate-Pearlescent Films	1.360	1.360

Celllulose Diacetate-Gloss Film	1.310	1.310
Celllulose Diacetate-Integuard Films	1.280	1.320
Celllulose Diacetate-Matt Film	1.310	1.310
Cellulose Diacetate-Window Patch Film (Food Grade)	1.310	1.310
Cellulose Diacetate-Clareflect metallized film	1.310	1.310
Cellulose Diacetate-Colored Films	1.310	1.310
Cellulose Diacetate-Flame retardant Film	1.340	1.360
Cellulose Diacetate-High Slip Film	1.310	1.310
Cellulose Diacetate-Semitone Films	1.310	1.310
CP - Cellulose Proprionate	1.170	1.240
COC - Cyclic Olefin Copolymer	1.010	1.030
CPVC - Chlorinated Polyvinyl Chloride	1.500	1.550
ETFE - Ethylene Tetrafluoroethylene	1.700	1.700
EVA - Ethylene Vinyl Acetate	0.920	0.940
EVOH - Ethylene Vinyl Alcohol	1.100	1.200
FEP - Fluorinated Ethylene Propylene	2.100	2.200
HDPE - High Density Polyethylene	0.940	0.970
HIPS - High Impact Polystyrene	1.030	1.060
HIPS Flame Retardant V0	1.150	1.170
Ionomer (Ethylene-Methyl Acrylate Copolymer)	0.940	0.970
LCP - Liquid Crystal Polymer	1.400	1.400
LCP Carbon Fiber-reinforced	1.500	1.500
LCP Glass Fiber-reinforced	1.500	1.800
LCP Mineral-filled	1.500	1.800

LDPE - Low Density Polyethylene	0.917	0.940
LLDPE - Linear Low Density Polyethylene	0.915	0.950
MABS - Transparent Acrylonitrile Butadiene Styrene	1.080	1.080
PA 11 - (Polyamide 11) 30% Glass fiber reinforced	1.250	1.270
PA 11, Conductive	1.130	1.130
PA 11, Flexible	1.030	1.050
PA 11, Rigid	1.020	1.030
PA 12 (Polyamide 12), Conductive	1.140	1.140
PA 12, Fiber-reinforced	1.070	1.410
PA 12, Flexible	1.010	1.040
PA 12, Glass Filled	1.220	1.420
PA 12, Rigid	1.010	1.010
PA 46 - Polyamide 46	1.170	1.190
PA 46, 30% Glass Fiber	1.420	1.440
PA 6 - Polyamide 6	1.120	1.140
PA 6-10 - Polyamide 6-10	1.090	1.100
PA 66 - Polyamide 6-6	1.130	1.150
PA 66, 30% Glass Fiber	1.370	1.370
PA 66, 30% Mineral filled	1.350	1.380
PA 66, Impact Modified, 15-30% Glass Fiber	1.250	1.350
PA 66, Impact Modified	1.050	1.100
PA 66, Carbon Fiber, Long, 30% Filler by Weight	1.300	1.300
PA 66, Carbon Fiber, Long, 40% Filler by	1.350	1.350

Weight		
PA 66, Glass Fiber, Long, 40% Filler by Weight	1.450	1.450
PA 66, Glass Fiber, Long, 50% Filler by Weight	1.600	1.600
Polyamide semi-aromatic	1.040	1.060
PAI - Polyamide-Imide	1.400	1.400
PAI, 30% Glass Fiber	1.600	1.600
PAI, Low Friction	1.400	1.500
PAN - Polyacrylonitrile	1.100	1.150
PAR - Polyarylate	1.200	1.260
PARA (Polyarylamide), 30-60% glass fiber	1.430	1.770
PBT - Polybutylene Terephthalate	1.300	1.400
PBT, 30% Glass Fiber	1.500	1.600
PC (Polycarbonate) 20-40% Glass Fiber	1.350	1.520
PC (Polycarbonate) 20-40% Glass Fiber Flame Retardant	1.400	1.500
PC - Polycarbonate, high heat	1.150	1.200
PC/PBT Blend - Polycarbonate/Polybutylene Terephthalate Blend	1.170	1.300
PC/PBT blend, Glass Filled	1.300	1.590
PCL - Polycaprolactone	1.140	1.140
PCTFE - Polymonochlorotrifluoroethylene	2.100	2.200
PE - Polyethylene 30% Glass Fiber	1.200	1.280
PE/TPS Blend - Polyethylene/Thermoplastic Starch	1.000	1.050

PEEK - Polyetheretherketone	1.260	1.320
PEEK 30% Carbon Fiber-reinforced	1.400	1.440
PEEK 30% Glass Fiber-reinforced	1.490	1.540
PEI - Polyetherimide	1.270	1.300
PEI, 30% Glass Fiber-reinforced	1.500	1.600
PEI, Mineral Filled	1.400	1.500
PEKK (Polyetherketoneketone), Low Cristallinity Grade	1.270	1.280
PESU - Polyethersulfone	1.370	1.460
PESU 10-30% glass fiber	1.500	1.600
PET - Polyethylene Terephthalate	1.300	1.400
PET, 30% Glass Fiber-reinforced	1.500	1.600
PET, 30/35% Glass Fiber-reinforced, Impact Modified	1.500	1.500
PETG - Polyethylene Terephthalate Glycol	1.270	1.380
PFA - Perfluoroalkoxy	2.100	2.200
PGA - Polyglycolides	1.400	1.600
PHB - Polyhydroxybutyrate	1.300	1.500
PI - Polyimide	1.310	1.430
PLA - Polylactide	1.230	1.250
PLA, Fiber Melt Spinning	1.230	1.250
PLA, Heat Seal Layer	1.230	1.250
PLA, High Heat Films	1.230	1.250
PLA,injection molding	1.240	1.260
PLA, Spunbond	1.230	1.250
PLA, Stretch blow molded bottles	1.230	1.250

PMMA - Polymethylmethacrylate/Acrylic	1.170	1.200
PMMA (Acrylic) High Heat	1.150	1.250
PMMA (Acrylic) Impact Modified	1.100	1.200
PMP - Polymethylpentene	0.835	0.840
PMP 30% Glass Fiber-reinforced	1.050	1.050
PMP Mineral Filled	1.080	1.100
POM - Polyoxymethylene (Acetal)	1.410	1.420
POM (Acetal) Impact Modified	1.300	1.350
POM (Acetal) Low Friction	1.400	1.540
POM (Acetal) Mineral Filled	1.500	1.600
PP - Polypropylene 10-20% Glass Fiber	0.970	1.050
PP, 10-40% Mineral Filled	0.970	1.250
PP, 10-40% Talc Filled	0.970	1.250
PP, 30-40% Glass Fiber-reinforced	1.100	1.230
PP (Polypropylene) Copolymer	0.900	0.910
PP (Polypropylene) Homopolymer	0.900	0.910
PP Homopolymer, Long Glass Fiber, 30% Filler by Weight	1.100	1.100
PP Homopolymer, Long Glass Fiber, 40% Filler by Weight	1.200	1.200
PP Homopolymer, Long Glass Fiber, 50% Filler by Weight	1.300	1.300
PP, Impact Modified	0.880	0.910
PPA - Polyphthalamide	1.110	1.200
PPA, 33% Glass Fiber-reinforced – High Flow	0.140	0.150
PPA, 45% Glass Fiber-reinforced	1.580	1.600

PPE - Polyphenylene Ether	1.040	1.100
PPE, 30% Glass Fiber-reinforced	1.260	1.280
PPE, Flame Retardant	1.060	1.100
PPE, Impact Modified	1.000	1.100
PPE, Mineral Filled	1.200	1.250
PPS - Polyphenylene Sulfide	1.350	1.350
PPS, 20-30% Glass Fiber-reinforced	1.400	1.600
PPS, 40% Glass Fiber-reinforced	1.600	1.700
PPS, Conductive	1.400	1.800
PPS, Glass fiber & Mineral-filled	1.800	2.000
PPSU - Polyphenylene Sulfone	1.290	1.300
PS (Polystyrene) 30% glass fiber	1.250	1.250
PS (Polystyrene) Crystal	1.040	1.050
PS, High Heat	1.040	1.050
PSU - Polysulfone	1.240	1.250
PSU, 30% Glass finer-reinforced	1.400	1.500
PSU Mineral Filled	1.500	1.600
PTFE - Polytetrafluoroethylene	2.100	2.200
PTFE, 25% Glass Fiber-reinforced	2.200	2.300
PVC (Polyvinyl Chloride), 20% Glass Fiber-reinforced	1.450	1.500
PVC, Plasticized	1.300	1.700
PVC, Plasticized Filled	1.150	1.350
PVC Rigid	1.350	1.500
PVDC - Polyvinylidene Chloride	1.600	1.750
PVDF - Polyvinylidene Fluoride	1.700	1.800

SAN - Styrene Acrylonitrile	1.060	1.100
SAN, 20% Glass Fiber-reinforced	1.200	1.400
SMA - Styrene Maleic Anhydride	1.050	1.080
SMA, 20% Glass Fiber-reinforced	1.200	1.200
SMA, Flame Retardant V0	1.200	1.200
SMMA - Styrene Methyl Methacrylate	1.050	1.130
SRP - Self-reinforced Polyphenylene	1.190	1.210
TPI-PEEK Blend, Ultra-high heat, Chemical Resistant, High Flow, 240C UL RTI	1.380	1.380
TPS/PE BLend - Thermoplastic Starch/ Polyethylene Blend (30 micron films tested)	1.150	1.200
TPS, Injection General Purpose	1.400	1.650
TPS, Water Resistant	1.340	1.380
UHMWPE - Ultra High Molecular Weight Polyethylene	0.930	0.950
XLPE - Crosslinked Polyethylene	0.915	1.400