The Periodic Table of the elements by Medvedev was a historic achievement in chemistry and enabled chemists to see the relationship between structure and properties of the basic elements.

Polymers also have a strong relationship between structure and properties and this 'Periodic Table of Polymers' is a first attempt to provide a simple codification of the basic polymer types and structures.

The diversity of polymer types makes it impossible to include all of the variations in one simple table and this table only includes the most common polymers.

Tangram Technology
Periodic Table of Thermoplastics

TANGRAM TECHNOLOGY — Consulting Engineers

KEY

TS = Tensile Strength at Yield @ 23°C
EAB = Elongation at break
TM = Tensile Modulus @ 23°C
LTST = Long Term Service Temperature
HDT = Heat Deflection Temperature @ 1.8 MPa
Cost = Relative Cost

All properties are for the natural injection moulding grade resin only and do not include polymers with reinforcements or other functional fillers.

Increasing performance

Commodity | **Engineering** | **Performance**

Amorphous / **Semicrystalline** — **Increasing crystallinity**

Random molecular orientation in both molten and solid phases.

General Characteristics

Soften gradually.
Generally transparent.
Lower Tensile Strength and Tensile Modulus.
Lower Density.
Low Creep Resistance.
High Dimensional Stability.
Low fatigue resistance.
Easy to bond using adhesives and solvents (high surface energy).

PS-HI High Impact Polystyrene
TS: 19 - 33 MPa
EAB: 40 - 50%
TM: 1.8 GPa
LTST: 55 - 60°C
HDT = 60 - 80°C
Cost: ◆

PS-GP General Purpose Polystyrene
TS: 40 - 50 MPa
EAB: < 3%
TM: 3.2 - 3.5 GPa
LTST: 70 - 85°C
HDT: 72 - 82°C
Cost: ◆

ABS Acrylonitrile Butadiene Styrene (Copolymer)
TS: 40 - 60 MPa
EAB: 3 - 20%
TM: 2.0 - 2.6 GPa
LTST: 80 - 95°C
HDT = 90 - 100°C
Cost: ◆

SAN Styrene Acrylonitrile (Copolymer)
TS: 47 - 72 MPa
EAB: 2.0 - 10%
TM: 2.3 - 4.1 GPa
LTST: 55 - 60°C
HDT = 84 - 95°C
Cost: ◆◆

PMMA Polymethylmethacrylate (Acrylic)
TS: 56 - 70 MPa
EAB: 3.0 - 3.5%
TM: 3.0 GPa
LTST: 90°C
HDT = 85 - 95°C
Cost: ◆◆◆

PPO (Modified) Polyphenylene Oxide
TS: 40 -- 90 MPa
EAB: 10 - 60%
TM: 2.0 - 5.4 GPa
LTST: 80 - 260°C
HDT = 129°C
Cost: ◆◆

PC Polycarbonate
TS: 55 - 75 MPa
EAB: 110 - 120%
TM: 1.6 - 2.4 GPa
LTST: 95 - 154°C
HDT = 135 - 140°C
Cost: ◆◆

PAR Polyarylate
TS: 68 - 71 MPa
EAB: 50 - 100%
TM: 2.0 - 2.2 GPa
LTST: 130 - 150°C
HDT = 165 - 175°C
Cost: ◆◆◆

PSU Polysulphone
TS: 70 - 76 MPa
EAB: 10 - 80%
TM: 1.5 - 2.7 GPa
LTST: 150 - 180°C
HDT = 160 - 174°C
Cost: ◆◆◆

PES Polyethersulphone
TS: 70 - 95 MPa
EAB: 40 - 80%
TM: 2.4 - 2.6 GPa
LTST: 180 - 220 °C
HDT = 200 - 210°C
Cost: ◆◆◆

PPSU Polyethersulphone (Block copolymer)
TS: 83 MPa
EAB: 40 - 80%
TM: 2.65 GPa
LTST: 180°C
HDT = 204°C
Cost: ◆◆◆◆

PVC-P Plasticised Polyvinylchloride
TS: 6 - 20 MPa
EAB: 50 - 460%
TM: 0.002 - 0.020 GPa
LTST: 50°C
HDT: 20 -C
Cost: ◆

SBS Styrene-Butadiene-Styrene (Copolymer)
TS: 35 - 40 MPa
EAB: 40%
TM: 1.8 - 2.0 GPa
LTST: 60°C
HDT = 67°C
Cost: ◆◆

SMA Styrene-Maleic Anhydride (Copolymer)
TS: 40 - 52 MPa
EAB: 1.8%
TM: 2.0 GPa
LTST: 100°C
HDT = 105°C
Cost: ◆◆

ASA Acrylonitrile Styrene Acrylate (Copolymer)
TS: 38 - 70 MPa
EAB: 15 - 45%
TM: 2.3 - 2.9 GPa
LTST: 82 - 120°C
HDT = 82 - 120°C
Cost: ◆◆

SB Styrene-Butadiene (Copolymer)
TS: 26 - 30 MPa
EAB: 20 - 80%
TM: 1.8 GPa
LTST: 65 - 77°C
HDT = 70 - 77°C
Cost: ◆◆

PEI Polyetherimide
TS: 100 - 105 MPa
EAB: 40 - 60%
TM: 2.7 - 4.5 GPa
LTST: 170 - 215°C
HDT = 200 - 215°C
Cost: ◆◆◆◆

PAI Polyamideimide
TS: 90 - 150 MPa
EAB: 2.6 - 12%
TM: 2.5 - 8.8 GPa
LTST: 220 - 280°C
HDT = 275 - 280°C
Cost: ◆◆◆◆◆

PI Polyimide
TS: 72 - 90 MPa
EAB: 6 - 8%
TM: 1.3 - 4 GPa
LTST: 260 - 300°C
HDT = 280 - 360°C
Cost: ◆◆◆◆◆

PBI Polybenzimideazole
TS: 120 - 160 MPa
EAB: 2.6 - 3.0%
TM: 4.0 - 6.5 GPa
LTST: 260 - 400°C
HDT = 220°C
Cost: ◆◆◆◆◆

PVC-U Unplasticised Polyvinylchloride
TS: 45 - 55 MPa
EAB: 25 - 60 %
TM: 2.50 - 3.02 GPa
LTST: 60 - 70 °C
HDT: 64 - 70°C
Cost: ◆

CA Cellulose Acetate
TS: 30 - 55 MPa
EAB: 5 - 55%
TM: 1.6 GPa
LTST: 45 - 70°C
HDT: 48 - 65°C
Cost: ◆◆

CAB Cellulose Acetate Butyrate
TS: 26 - 50 MPa
EAB: 8 - 80%
TM: 0.7 - 1.5 GPa
LTST: 75 - 100°C
HDT: 62 - 70°C
Cost: ◆◆

CAP Cellulose Acetate Propionate
TS: 26 - 47 MPa
EAB: 30 - 100%
TM: 0.7 - 1.5 GPa
LTST: 75 - 100°C
HDT: 45 - 75°C
Cost: ◆◆

CP Cellulose Propionate
TS: 30 - 45 MPa
EAB: 45 - 65%
TM: 0.8 - 1.5 GPa
LTST: 68 - 100°C
HDT: 61 - 73°C
Cost: ◆◆

PET-G Glycolised Polyethylene terephthlate
TS: 55 MPa
EAB: 300%
TM: GPa
LTST: 60°C
HDT: 70°C
Cost: ◆◆◆

PVC-UX Crosslinked Unplasticised PVC
TS: 28 - 40 MPa
EAB: 150 %
TM: 2.5 - 3.0 GPa
LTST: 70 - 95°C
HDT: 120°C
Cost: ◆◆◆

PVC-C Chlorinated Polyvinylchloride
TS: 53 - 58 MPa
EAB: 25 - 45%
TM: 2.6 - 2.7 GPa
LTST: 90 - 110°C
HDT: 105°C
Cost: ◆◆◆

PVC-U High-Impact Unplasticised PVC
TS: 45 - 55 MPa
EAB: 25 - 60 %
TM: 2.5 - 3.0 GPa
LTST: 60 - 70 °C
HDT: 64 - 70°C
Cost: ◆

PA 6/3/T Amorphous polyamide
TS: 60 - 100 MPa
EAB:> 50 %
TM: 1.4 - 2.3 GPa
LTST: 125°C
HDT = 102 - 123°C
Cost: ◆◆◆

PPA Polyphthalamide (Amorphous)
TS: 85 MPa
EAB: 2.6%
TM: 3.7 GPa
LTST: 140°C
HDT = 138°C
Cost: ◆◆◆◆

PARA Polyaryl amide
TS: 60 MPa
EAB: 100%
TM: 24 GPa
LTST: 150°C
HDT = 150°C
Cost: ◆◆◆◆

Random molecular orientation in molten phase, densely packed crystallites in solid phase.

General Characteristics

Sharp melting point.
Generally translucent or opaque.
Higher Tensile Strength and Tensile Modulus.
Higher Density.
High Creep Resistance.
Low Dimensional Stability.
High fatigue resistance.
Difficult to bond using adhesives and solvents (low surface energy).

PE-LD Low Density Polyethylene
TS: 7.0 - 25 MPa
EAB: 50 - 600%
TM: 0.15 - 0.35 GPa
LTST: 40 - 70°C
HDT = 35°C
Cost: ◆

PE-LLD Linear Low Density Polyethylene
TS: 8.0 - 20 MPa
EAB: 50 - 500%
TM: 0.2 - 1.0 GPa
LTST: 44 - 50°C
HDT = 37 - 44°C
Cost: ◆

PE-MD Medium Density Polyethylene
TS: 14 - 25 MPa
EAB: 50 - 300%
TM: 0.25 - 0.70 GPa
LTST: 38 - 70°C
HDT = 38 - 43°C
Cost: ◆◆

PMP Polymethyl pentene
TS: 25 - 28 MPa
EAB: 15 - 30%
TM: 1.0 - 2.2 GPa
LTST: 55 - 60°C
HDT = 40 - 50°C
Cost: ◆◆◆

EVA Ethylene-vinyl Acetate (12% VA)
TS: 10 - 19 MPa
EAB: 50 - 750%
TM: 0.04 - 0.14 GPa
LTST: 50°C
HDT = 20 - 23°C
Cost: ◆◆◆

PE-X Crosslinked Polyethylene
TS: 18 MPa
EAB: 350%
TM: 0.6 GPa
LTST: 90°C
HDT = 60°C
Cost: ◆◆◆

PB Polybutene-1 (Polybutylene)
TS: 12 - 17 MPa
EAB: 300 - 380%
TM: 0.21 - 0.26 GPa
LTST: 110°C
HDT = 54 - 60°C
Cost: ◆◆◆◆

PE-UHMW Ultra-high Molecular Weight Polyethylene
TS: 35 MPa
EAB: 500%
TM: 0.5 GPa
LTST: 55°C
HDT = 42°C
Cost: ◆◆◆

PA 11 Polyamide 11 (Nylon 11)
TS: 20 - 60 MPa
EAB: 30 - 400%
TM: 1.0 - 2.0 GPa
LTST: 74 - 147°C
HDT = 38 - 55°C
Cost: ◆◆◆

PA 12 Polyamide 12 (Nylon 12)
TS: 50 MPa
EAB: 200%
TM: 1.2 - 1.6 GPa
LTST: 70 - 80°C
HDT = 55°C
Cost: ◆◆◆

PPA Polyphthalamide
TS: 85 MPa
EAB: 2.6%
TM: 3.7 GPa
LTST: 140°C
HDT = 138°C
Cost: ◆◆◆

PEK Polyetherketone
TS: 52 - 214 MPa
EAB: 1.3 - 330%
TM: 1.5 - 18.6 GPa
LTST: 90 - 334°C
HDT = 93 - 334°C
Cost: ◆◆◆◆

PEEK Polyetheretherketone
TS: 90 - 110 MPa
EAB: 2.5 - 100%
TM: 3.1 - 8.3 GPa
LTST: 154 - 315°C
HDT = 154 - 295°C
Cost: ◆◆◆◆◆

PE-Chlorinated Chlorinated Polyethylene
TS: 12.5 MPa
EAB: 700%
TM: 0.002 GPa
LTST: 60°C
HDT = 25°C
Cost: ◆◆◆

PE-VLD Very Low Density Polyethylene
TS: 34 - 400 MPa
EAB: 400 - 700%
TM: 0.10 - 0.20 GPa
LTST: 60°C
HDT = 75 - 95°C
Cost: ◆◆◆

EMA Ethylene-methyl Acrylate
TS: 9 - 12 MPa
EAB: 750 - 800%
TM: 0.03 GPa
LTST: 55°C
HDT = 59°C
Cost: ◆◆◆

PBT Polybutylene-terephthlate
TS: 30 - 105 Mpa
EAB: 250%
TM: 1.5 - 5.2 GPa
LTST: 65 - 120°C
HDT: 70°C
Cost: ◆◆

PA 6 Polyamide 6 (Nylon 6)
TS: 40 - 50 MPa
EAB: 150 - 250%
TM: 1.2 - 2.8 GPa
LTST: 80 - 120°C
HDT = 60 - 90°C
Cost: ◆◆

PA 66 Polyamide 66 (Nylon 66)
TS: 40 - 86 MPa
EAB: 4.8 - 300%
TM: 0.7 - 3.3 GPa
LTST: 60 - 235°C
HDT = 50 - 164°C
Cost: ◆◆◆

PA 6/6 Polyamide 6/6 (Nylon 6/6)
TS: 50 - 65 MPa
EAB: 50 - 200%
TM: 1.6 - 3.0 GPa
LTST: 85 - 150°C
HDT = 70 - 110°C
Cost: ◆◆◆

LCP Liquid Crystal Polymer (Aromatic copolyester)
TS: 55 - 165 Mpa
EAB: 1.3 - 2.8%
TM: 2 - 20 GPa
LTST: 230°C
HDT: 200°C
Cost: ◆◆◆◆

PFA Perfluoroalkoxy
TS: 15 - 30 MPa
EAB: 300%
TM: 0.60 GPa
LTST: 260°C
HDT = 48 - 60°C
Cost: ◆◆◆◆◆

ECTFE Ethylene-chlorotrifluoroethylene
TS: 42 - 48 MPa
EAB: 200%
TM: 1.4 GPa
LTST: 140 - 166°C
HDT = 63 - 67°C
Cost: ◆◆◆◆◆

PCTFE Polychloro-trifluoroethylene
TS: 30 - 40 MPa
EAB: 175%
TM: 1.3 GPa
LTST: 140 - 150°C
HDT = 67 - 75°C
Cost: ◆◆◆◆◆

PTFE Polytetrafluorethylene
TS: 17 - 21 MPa
EAB: 140 - 400%
TM: 0.35 - 0.75 GPa
LTST: 250 - 260°C
HDT = 50 - 60°C
Cost: ◆◆◆◆

PP Polypropylene (Homopolymer)
TS: 33 MPa
EAB: 150%
TM: 1.5 GPa
LTST: 100°C
HDT = 65°C
Cost: ◆

PP Polypropylene (Copolymer)
TS: 25 MPa
EAB: 300%
TM: 1.2 GPa
LTST: 90°C
HDT = 60°C
Cost: ◆

PET Crystalline Polyethylene-terephthlate
TS: 57 - 75Mpa
EAB: 50 - 200%
TM: 2.47 - 3.0GPa
LTST: 63 - 100°C
HDT: 63 - 100°C
Cost: ◆◆

PA 6/10 Polyamide 6/10 (Nylon 6/10)
TS: 50 - 60 MPa
EAB: 70 - 150%
TM: 1.5 - 2.8 GPa
LTST: 60 - 110°C
HDT = 65 - 85°C
Cost: ◆◆◆

PA 6/12 Polyamide 6/12 (Nylon 6/12)
TS: 17 - 60 MPa
EAB: 4 - 600%
TM: 0.29 - 5.5 GPa
LTST: 42 - 190°C
HDT = 50 - 90°C
Cost: ◆◆◆

POM Polyoxymethylene (Acetal Copolymer)
TS: 62 - 70 MPa
EAB: 20 - 75%
TM: 2.8 - 3.1 GPa
LTST: 104°C
HDT = 110°C
Cost: ◆◆

EVOH Ethylene-vinyl Alcohol
TS: 37 - 205 MPa
EAB: 100 - 330%
TM: 1.9 - 3.5GPa
LTST: 80 - 100°C
HDT =70 - 90°C
Cost: ◆◆◆◆

PPS Polyphenylene Sulphide
TS: 69 - 124 MPa
EAB: 1 - 5%
TM: 2.2 - 5.5 GPa
LTST: 190 - 260°C
HDT = 174°C
Cost: ◆◆◆

FEP Fluorinated ethylene-propylene
TS: 15 - 21 MPa
EAB: 240 - 350%
TM: 0.35 - 0.50 GPa
LTST: 60 - 204°C
HDT = 48 - 60°C
Cost: ◆◆◆◆◆

ETFE Ethylene-tetrafluoroethylene
TS: 35 - 45 MPa
EAB: 200 - 500%
TM: 1.00 GPa
LTST: 160°C
HDT = 90°C
Cost: ◆◆◆◆◆

PVDF Polyvinylidenefluoride
TS: 30 - 55 MPa
EAB: 50%
TM: 1.3 GPa
LTST: 150°C
HDT = 75 - 82°C
Cost: ◆◆◆◆

PE-HD High Density Polyethylene
TS: 10 - 50 MPa
EAB: 400 - 800%
TM: 0.18 - 1.6 GPa
LTST: 55°C
HDT = 46°C
Cost: ◆

POM Polyoxymethylene (Acetal Homopolymer)
TS: 67 - 85 MPa
EAB: 15 - 70%
TM: 2.9 - 3.6 GPa
LTST: 85 °C
HDT = 124°C
Cost: ◆◆

KEY TO MAJOR POLYMER FAMILIES:

Styrenes | Polyolefins | Polyamides | Fluoropolymers | Vinyls | Acrylics | Cellulosics | Imides | Acetals | Polycarbonates | Polysulphones

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