

## Properties of Synthetic Fibers (page 1)

Fiber	Composition	Development date	Common trade name	Density	Denier (g/9000m)	Tenacity (g/denier)	Elongation at break (%)	Initial modulus	Moisture regain (%)
acetate	cellulose triacetate	1919	Celanese; Arnel; Tenite	1.25-1.35		1.1-1.4 (dry); 0.65-0.75 (wet)	25-35 (dry); 35-45 (wet)	35-40	6.5
acrylic	>85% acrylonitrile	1950	Acrilan, Creslan, Courtelle, Orlon	1.16-1.18	2-8	2-3.6 (dry)	20-55	25-63	1.0-3.0
aramid (meta)	poly-m-phenylene terephthalamide		Nomex, Conex	1.38	2-5	3-6	2-30	130-150	3.5
aramid (para)	poly-p-phenylene terephthalamide	1965	Kevlar	1.44	1.0-1.5	25-30	3-6	500-1000	7.0
azlon	protein	1930s	Aralac, Ardil, Lanital	1.25-1.3		0.9-1.1 (dry); 0.3-0.6 (wet)	60-70		14
modacrylic	35-85% acrylonitrile	1949	Dynel; Verel, SEF	1.35-1.37	2-8	1.8-2.5 (dry); 1.7-2.4 (wet)	35-48	25-56	0.4-4.0
nylon 6	polycaprolactam	1939	Perlon; Kapron, Power silk	1.14	1.5-5	3.8-8.3 (dry); 3.5-7.1 (wet)	16-50 (dry); 19-55 (wet)	25-35	3.5-5.0
nylon 6,6	polyhexamethylene adipamide	1935	Fiber 66; Antron; Stainmaster	1.14	1.5-5	4.6-9.0 (dry); 4.0-7.7 (wet)	19-40% (dry); 32-46% (wet)	33-46	3.8-4.5
nytril	>85% vinylidene dinitrile	1955; discontinued in 1970s	Darvan	1.18		2.0 (dry); 1.7 (wet)	30		2-3
polyester	polyester terephthalate	1941	Dacron, Terylene; Hollytex		1.5-5	2.2-9.5	10-50	25-50	0.1-0.4
polyethylene	high density polyethylene	1954	Tyvek; Reevon	0.95-0.96	2-10	5.0-8.0	14-20		<0.1
polypropylene	polypropylene	1957	Herculon, Marvess	0.85-0.94	2-10	3.5-9.0	15-35	29-45	<0.1
polyurethane	>85%polyurethane	1958	spandex, Lycra	1.20-1.25	2.5-20	0.5-1.5	500-700		0.3-1.2
polyvinyl chloride	>85% vinyl chloride units		vinylon; Eviilon, Thermovyl	1.38-1.40		2.7-3.0 (wet or dry)	12-20		0
rayon (cupro)	regenerated cellulose	1890	Cuprama; Cupresa	1.54	2-3	1.7-2.3 (dry); 1.1-1.135 (wet)	10-17 (dry); 17-23 (wet)		11-12.5
rayon (viscose)	regenerated cellulose	1892	Avtex	1.46-1.54	2-3	2.0-2.6 (wdry); 1.0-1.5 (wet)	13-15 (dry); 20-40 (wet)		11-16.6
vinal	>50% vinyl alcohol units	1924	Synthofil; Vinylon	1.26-1.30		3.0 -8.5 (dry); 3.2-7.6 (wet)	9-26 (dry); 10-27 (wet)		3.0-9.0

## Properties of Synthetic Fibers (page 2)

Fiber	Degradation	Dyes used	Microscopic characteristics	Applications
acetate	Degrades in acids and concentrated alkalis	disperse	Irregular cross section with multiple lobes; lengthwise striations	coats, suits, linings, cigarette filters
acrylic	Susceptible to heat; accumulates static charge	basic, disperse, pigment	variable cross section	substitute for wool in coats, sweaters, hosiery, blankets, filters
aramid (meta)	Degraded by acids, alkalis, oxidizing agents and UV light		fiber is smooth; cross section is dogbone	filter bags for hot stack gases, flame-resistant clothing
aramid (para)	Degraded by acids, alkalis, oxidizing agents and UV light		fiber is smooth, cross section is circular	radial tires belts, bulletproof vests, resin reinforcements
azlon	Degraded by alkalis; weak when wet; susceptible to microbiological growths		diameter=20-30 microns, cross section is circular or bean-shaped, filament is smooth	silk substitute
modacrylic	Resistant to alkalis and acids			flame-resistant clothing, artificial fur, children's sleepwear, tents
nylon 6	Degraded by concentrated acids and phenol; resistant to alkalis and most organic solvents	acid, disperse, mordant, pigment, reactive	fiber is smooth, cross section is circular	hosiery, lingerie, sports garments, upholstery
nylon 6,6	Degraded by concentrated acids and phenol; resistant to alkalis and most organic solvents	acid, disperse, mordant, pigment, reactive	fiber is smooth, cross section is circular or trilobal	tires, ropes, seat belts, parachutes, fishing lines and nets; surgical sutures; brushes
nytril	Resistant to sunlight, oxidation and insects.		opaque, white with flattened or hook-shaped cross section	sweaters, pile fabrics, in wool blends
polyester	Degrades in strong acids, strong alkalis and cresol.	disperse, pigment	smooth fibers; cross section may be circular, trilobal or polygon	permanent press clothing, fiberfill, carpets, sewing thread, seat belts, yarns, nonwoven fabrics
polyethylene	Resistant to acids, alkalis and bleaches; dissolves in dry-cleaning solvents, degrades slowly in sunlight	basic, disperse pigments	cross section is circular or elliptical	cordage, webbing; upholstery, outdoor applications
polypropylene	Resistant to strong acids and alkalis; resistant to biodeterioration	basic, disperse pigments	cross section is circular or elliptical	upholstery, carpets, ropes, nets, disposable nonwoven fabrics
polyurethane	Chlorine causes slow degradation	acid, disperse, reactive, vat		elastomeric fabrics; swimwear; athletic clothes
polyvinyl chloride	Soluble in chlorinated and aromatic solvents; degrades with heat and light	basic, disperse, pigment	irregular cross section	elastomeric fabrics; outdoor fabrics (tents, awnings, rain gear etc)
rayon (cupro)	Degrades in strong alkalis, acids and undiluted bleaches. Resistant to dry cleaning solvents		circular cross section with no striations	sheer fabrics and netting; lightbulb filaments
rayon (viscose)	Degrades in strong alkalis, acids and undiluted bleaches. Resistant to dry cleaning solvents	direct	lengthwise striations; early samples have circular cross sections with serrations, later samples may be dog-boned or trilobal	rugs, cotton substitute, nonwoven fabrics, paper (cellophane)
vinal	Resistant to microorganisms, insects, and most chemicals.		fibers are smooth; cross section is round, bean-shaped or u-shaped	raincoats, jackets, umbrellas, tarps, fishnets, awnings.