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UD FLAX/EPOXY MECHANICAL PROPERTIES

1. Fibre Volume fraction

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
HAND LAY-UP						Mean	STDEV	
UD fabric provided by Libeco Lagae composed of flax yarns linked with a few yarns in the 90° direction	Epoxy resin SR1500 and hardener SD2503 provided by Sicomin	"Dry" yarns were dried at 103°C ± 3°C to constant mass	Hand lay-up pressed with a vacuum bag at 950 mbar and cured at ambient temperature	Hand lay-up	5	32.8	1.3	[1]
UD fabric provided by Libeco Lagae composed of flax yarns linked with a few yarns in the 90° direction	Epoxy resin SR1500 and hardener SD2503 provided by Sicomin	"Wet" yarns were stored in a regulated chamber (23 ± 2°C and 55 ± 5% relative humidity) until equilibrium is reached	Hand lay-up pressed with a vacuum bag at 950 mbar and cured at ambient temperature	Hand lay-up	5	37.4	0.7	[1]
UD flax fibres reinforcement made of 200 tex yarns supplied by Safilin Inc. with an areal weight of 180 g/m^2	Adtech 820 Epoxy resin	Chemically treated to improve the fibre-matrix interface	Hand impregnation with a roller followed by curing under vacuum Post cure at 75°C for 16 hours	Hand lay-up	1	33.5		[2]
COMPRESSION MOULDING								

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
UD Flax fibres (marylin variety)	Epoxy resin (Axson, Epolam 2020)	As received	Compression moulding	Compression moulding	10	54	3	[3]
UD Flax fibres (Andrea variety)	Epoxy resin (Axson, Epolam 2020)	As received	Compression moulding	Compression moulding	10	51	4	[3]
UD Flax fibres (Hermes variety)	Epoxy resin (Axson, Epolam 2020)	As received	Compression moulding	Compression moulding	10	51	2	[3]
Flax fibres from flax long tows of the Hermes variety cultivated in 2002 UD manually aligned technical fibres (middle)	Epoxy resin (Axson 2015)	As received	Wet impregnation prior to compression moulding	Compression moulding	5	20.1		[4]
Flax fibres from flax long tows of the Hermes variety cultivated in 2002 UD manually aligned technical fibres (Top)	Epoxy resin (Axson 2015)	As received	Wet impregnation prior to compression moulding	Compression moulding	5	19.7		[4]
Flax fibres from flax long tows of the Hermes variety cultivated in 2002 UD manually aligned technical fibres (Bottom)	Epoxy resin (Axson 2015)	As received	Wet impregnation prior to compression moulding	Compression moulding	5	19.8		[4]
UD Flax bundles from the Silsoe Research Institute, mechanically decorticated	Low viscosity epoxy system S.P. Systems Ampreg 26	No treatment	Hand lay-up cured under vacuum with a steel top	Compression moulding	5	49	1	[5]
UD Flax fibres, Ariane Variety cultivated in Normandy (France)	Epoxy resin (Axson 2020)	As received	Compression moulding	Compression moulding	10	40.4	1.2	[6]
100% flax fibres in longitudinal direction (scotched and hackled) with an aeral weight	Epoxy resin 2020 from Axson	No treatment	Stacks were impregnated with resin in a wet-lay	Compression moulding		65		[7]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
of 200g/m^2 FlaxTape from Lineo			process and compressed at 50 bars using a press at ambient temperature					
Unidirectional reinforcement made of 100% flax fibres in the longitudinal direction with an areal weight of 200g/m^2 (Flax Tape from Lineo)	Epoxy resin Epolam 2020 from Axson	No treatment on the fibre surface	Each ply was impregnated in a wet lay-up process and stacked in a female mould. The plies were compressed using a press by the male mould with 50 bar pressure Curing for 24 hours at 25°C and post curing 3h at 40°C, 2h at 60°C, 2h at 80°C and 8h at 100°C	Compression moulding		60		[8]
UD flax fibres provided by Terre de Lin (France) from the Eden variety	Epolam 2020 resin		Compression moulding	Compression moulding	5	60	2	[9]
Scutched UD flax fibres	Epoxy resin Epolam 2020, Axson technologies	As received	Wet impregnation and compression moulding	Compression moulding	7	65	3.3	[10]
UD flax tows	Epoxy resin Epolam 2020, Axson technologies	Manually untangled and aligned	Wet impregnation and compression moulding	Compression moulding	7	62	2.7	[10]
HOT PRESS								

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with 40 strands in the 0° direction and 3 across within a unit square	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2h at 150°C	Hot press		49.6	2.3	[11]
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with a ratio of 0°-90° fibres of 40:3	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2.5 bar followed by 2h at 150°C and 5 bar	Hot press	5	50.97	3.92	[12]
UD Hackled flax fibres type Aramis from Terre de Lin company (France) dew-retted in 2013	Epoxy (Epikote 828 LVEL with Dytek DCH-99 hardener) provided by Resolution performance products	Fibres pre-dried for 24 h at 60C	Wet impregnation followed by heated plates compression	Hot Press	6	53	4.5	[13]
UD Hackled flax fibres type Aramis from Terre de Lin company (France) dew-retted in 2013	Epoxy Epolam 2020 with Epolam 2020 hardener supplied by Axson	Fibres pre-dried for 24 h at 60C	Wet impregnation followed by heated plates compression	Hot press	6	53	3	[13]
UD Hackled flax fibres type Aramis from Terre de Lin company (France) dew-retted in 2013	Epoxy SR 1500/2505 provided by Sicomin	Fibres pre-dried for 24 h at 60C	Wet impregnation followed by heated plates compression	Hot press	6	27	1	[13]
UD fabric, twisted flax-fibre yarn coming from wet spinning 180g/m^2	Epoxy resin Araldite LY 5150 resin and Aradur	No treatment	Hot platen press process with prepregs	Hot press	1	44		[14]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
	5021/XB3471 hardener from Huntsman							
UD Hermes Flax fibres 140g/m^2	Epoxy resin SR 8200/SD 8205 supplied by Sicomin	Used as received	Hand lay-up followed by hot platen curing (60°C for 8hrs)	Hot plate		43.9	1.5	[15]
UD flax fibres	Epoxy resin		Hot platen press process with prepregs	Hot press		51		[16]
UD dry flax fibres of the Hermes variety cultivated in northern France by CRST with an areal weight of 144g/m^2	SR 8200 resin and SD 8205 hardener supplied by Sicomin	As received	Hand lay-up followed by compression moulding with hot plates	Hot press		43.1	1.5	[17]
UD flax fabrics composed of parallel aligned twisted yarns in 0° direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2 provided by Lone company Belgium	Epoxy resin 618(E-51) based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent and accelerating agent (MeTHPA0 and DMP-30) were purchased Shanghai Zhongsi Industry Co., Ltd., China	UD fabric was dried in an oven at 120°C for 2 hours	Hand lay-up to produce prepreg and hot press machine manufacturing	Hot press	6	45		[18]
UD380 prepreg made of flax fibre with an areal weight of 400g/m^2 provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB		Prepreg cured in a hot press composed of a male and female mould for 30 min at	Hot press	1	57		[19]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
	3471 provided by Hunstman		80°C and 60 min at 130°C					
UD200 prepreg made of flax fibre with an areal weight of 223g/m^2 provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		Prepreg cured in a hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C	Hot press	1	60		[19]
FUD180 prepreg made of flax fibre with an areal weight of 180g/m^2 and 1/19 weft/warp ratio provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		Prepreg cured in a hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C	Hot press	1	64		[19]
UD flax fabric made of the Hermes variety with an areal density of 144g/m^2 , the fabric consisted of aligned flax UD fibres stitched by a cotton thread of 2g/m^2 supplied by BioRenforts	Epoxy system based on the resin SR 8200 with the SR 8205 hardener provided by SICOMIN	Used as received with no treatment	The plies were manually impregnated and hand-laid before being stacked under pressure of 7 bars in a hydraulic press equipped with heating plates (8 hours at 60°C)	Hot plates	1	40		[20]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	Hot press	1	45.0		[21]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	Hot press	1	45.4		[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	Hot press	1	46.1		[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	Hot press	1	45.6		[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	Hot Press	1	45.7		[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	Hot press	1	45.8		[21]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C	Hot press		51.0	1.4	[22]
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C	Hot press		51.1	1.4	[22]
Pure UD reinforcements FlaxTape 110 supplied by Lineo	DGEBA epoxy resin (SR 8500) and amine hardener (SZ 8525) system produced by Sicomin		Plies manually laid-up and impregnated in a thermos-compression press Cured under 1 bar pressure	Hot press		38		[23]
Pure UD reinforcements FlaxTape 110 supplied by Lineo	DGEBA epoxy resin (SR 8500) and amine hardener (SZ 8525) system produced by Sicomin		Plies manually laid-up and impregnated in a thermos-compression press Cured under 3 bars pressure	Hot press		45		[23]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
Pure UD reinforcements FlaxTape 110 supplied by Lineo	DGEBA epoxy resin (SR 8500) and amine hardener (SZ 8525) system produced by Sicomin		Plies manually laid-up and impregnated in a thermos-compression press Cured under 5 bars pressure	Hot press		51		[23]
RESIN INFUSION								
Individual flax fibres	Epoxy resin Axson 2015		Bag moulding under vaccum	Resin infusion	X	40		[24]
UD Flaxtape supplied by Lineo	Epoxy resin (Epikote 828 LV and Dytek DCH-99 hardener)	No Treatment	Vacuum Assisted Resin Infusion (VARI)	Resin infusion	X	40		[25]
Flax yarn processed in UD mats provided by Composites Evolution (UK)	Low-viscosity Epoxy Prime 20LV By Gurit	Cellulose based binder	Vacuum infusion	Resin infusion	5	26.9	0.1	[26]
Flax yarn processed in UD mats provided by Safilin (France)	Low-viscosity Epoxy Prime 20LV by Gurit	Cellulose based binder	Vacuum infusion	Resin Infusion	5	29.9	0.1	[26]
Quasi unidirectional flax fabrics UD 360 with an areal weight of 360 g/m^2 with 330 g/m^2 in the weft direction and 30 g/m^2 in the warp direction provided by Fibres Recherche Developpement (Troyes, France)	Epoxy resin DER 332 provided by Dow Chemicals (Midland, USA) and hardener IPDA provided by Sigma Aldrich (Saint-Louis, USA)		Vacuum infusion at 50% RH and 23°C and then cured at 80°C for 24h	Resin infusion	X	30		[27]
UD flax fibres with an areal weight of 110 g/m^2 provided by Lineo (Belgium)	A resin-infusion grade thermos-set resin and hardener Epolam 5015 supplied by Axson (France)	Fibres were dried at 80°C for 3 hours in a vacuum oven	Vacuum Assisted Resin Infusion (VARI)	Resin infusion	X	40	2	[28]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
			Cured for 24h at 25°C and post cured at 80°C for 16 h					
Unidirectional non-crimp flax yarn fabric Amplitex 5008 with an areal weight of 350 g/m^2 from BComp Ltd., Switzerland	Huntsmans Araldite 1568 / Aradur 3489 epoxy resin		Vacuum infusion Cured for 19hrs at 40°C and 5 hours at 75°C	Resin infusion	1	37		[29]
AUTOCLAVE/PREPREG								
UD flax fibres, Arianne, 1996, supplied by Tex-Dem N.V., Alveringem, Belgium	Epoxy HM533 supplied by Hexcel Composites	Untreated	Film stacking cured in autoclave under vacuum 1h at 3 bar and 125°C	Autoclave	X	40		[30]
UD Flax fibres (Arianne variety, 1996)	Epoxy resin film HM 533 from Hexcel	Untreated	Cured in an autoclave for 1h at 3 bar and 125°C	Autoclave	X	40		[31]
UD reinforced prepreg made fine flax roving (slightly twisted fibre slivers) supplied by Tex-Dem N.V., Alveringem, Belgium	Two parts epoxy system (resin LMB 6305 and hardener HY 5021 BD) manufactured by Vantico N.V., Belgium	Untreated	Drumwinder to manufacture prepreg cured in an autoclave 1h at 3 bar and 125°C	Prepreg / Autoclave	X	48		[30]
Hackled flax fibres from Terre de Lin (France) 30000 tex	Epoxy resin XB 3515/Aradur 5021 from Huntsman	No treatment	Prepreg and autoclave	Prepreg/autoclave	X	42	2	[32]
Roving flax fibres from Safilin 280 tex	Epoxy resin XB 3515/Aradur 5021 from Huntsman	No treatment	Drumwinder and autoclave	Drumwinder / prepreg / autoclave	X	48	1	[32]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
Flax yarns from Safilin 83.3 tex	Epoxy resin XB 3515/Aradur 5021 from Huntsman	No treatment	Drumwinder and autoclave	Drumwinder/ prepreg / autoclave	X	50	1	[32]
Unidirectional mats of flax obtained from Centexbel and random non-woven mats obtained from Tex-Dem (Belgium)	Epoxy resin HM 533 obtained from Hexcel	Untreated	Adhesive film and autoclave moulding	Autoclave	X	35		[33]
Quasi-UD woven flax epoxy prepreg with aerial density of reinforcement 170g/m^2 and 95.5% of flax fibres in the warp direction provided by LINEO (Belgium)	Epoxy resin (prepreg system Araldite LY5150/ Aradur 1571/ Accelerator 1573 / Hardener XB3471)	No treatment	Prepreg and autoclave	Prepreg/ autoclave	3	47	2	[34]
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa External pressure= 300 kPa	Autoclave		36.4	0.9	[22]
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa External pressure=300 kPa	Autoclave		44.0	1.1	[22]
FILAMENT WINDING								

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
UD Flax fibre yarns (twist = 277 t/m) supplied by J. Schilgen GmbH and Co.	Epoxy resin LY 5082/Hy 5083 provided by Ciba-Geigy GmbH Germany	Pre-treatment De-waxed in methanol-benzene	Filament winding technique	Filament winding	X	34		[35]
RTM								
Unidirectional biotechnically retted flax fibres "ArticFlax" grown in Finland and provided by FinFlax Oy	Epoxy resin XB 5082 with hardener HY5983 from Ciba	As received	RTM	RTM	X	47		[36]
Unidirectional retted flax fibres provided by Muhlmeier GmbH	Epoxy resin XB 5082 with hardener HY5983 from Ciba	As received	RTM	RTM	X	32		[36] [37]
UD flax fabrics "FlaxPly E-UD" with an aeral weight of 180g/m^2 purchased from LINEO, Belgium	Epoxy resin L-235 with a hardener Epoxy-Härter 236 purchased from Swiss-Composite	Fibres used as received	RTM	RTM	1	40		[38]
Quasi UD flax fibres with 90% of fibres in 0° direction and 10% in the 90° direction with an areal weight of 300 g/m^2 supplied by B-Comp	Epoxy resin Epikote 828LVEL and hardener Dytek DCH-99	Dry spun	RTM	RTM	X	40		[39]
UD flax fibres orientated at 0° with a areal weight of 200 g/m^2 supplied by Lineo	Epoxy resin Epikote 828LVEL and hardener Dytek DCH-99	Water treated	RTM	RTM	X	40		[39]
UD flax fabric with an areal weight of 200 g/m^2 purchased from Lineo, Belgium	Epoxy system consisting of an Araldite resin (NPEL-128), an amine cruing agent (EH-6303) and an accelerator (EH-6412)		Vacuum Assisted Resin Transfer Moulding (VARTM) Cured at room temperature for 24	RTM	X	37		[40]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
	supplied by Shanghai Zongsi Company		hours and post cured at 60°C for 8 hours					
UD flax fabrics PLAXPLY with an areal weight of 180 g/m^2 provided by Lineo	SR-8100 Epoxy resin produced by Sicomin	Fibres were dried at 60°C for 6 h before infusion	Vacuum Assisted Resin Transfer Moulding (VARTM) 24h at ambient temperature and post cured for 8h at 60°C under a 80 kPa vacuum	RTM	1	31		[41]
Quasi-unidirectional flax reinforcements FLAXDRY UD 180 with an areal weight of 180g/m^2 provided by Libeco	Fast curing epoxy resin SP106 provided by Gurit	No treatment	Vacuum Assisted Resin Transfer Moulding (VARTM) Infusion and curing at room temperature	RTM	6	41.4		[42]
Quasi-unidirectional flax reinforcements FLAXDRY UD 180 with an areal weight of 180g/m^2 provided by Libeco	Fast curing epoxy resin SP106 provided by Gurit	Thermal treatment at 220°C for 2 hours under inert atmosphere	Vacuum Assisted Resin Transfer Moulding (VARTM) Infusion and curing at room temperature	RTM	6	38.8		[42]
UD flax reinforcement with an areal density of 400g/m^2 made of untreated twisted flax yarns (Tex 1000) supplied by Safilin	820 epoxy /824 hardener system supplied by Adtech Plastic	No treatment	Resin transfer moulding	RTM	X	40	1.2	[43]
Unidirectional flax fibre fabric “Biotex Flax” manufactured by Composites Evolution Ltd., UK.	Epoxy resin system Araldite LY 8601 mixed with Aradur 8602 hardener produced by Huntsman Corporation	Fibres were placed to an oven at 80°C for 24h to dry prior to infusion	Vacuum assisted resin transfer moulding (VARTM) Post cured at 80°C for 24h	RTM	5	38		[44]

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
DISCARDED								
UD FlaxTape 200g/m^2 manufactured by Lineo	Elium RT 150 manufactured by ARKEMA	Water mist and dried for one hour at 110°C	Resin infusion	Resin infusion	5	35-40		[45]
UD warp knitted flax fibres 185 g/m^2 , weft yarn: long flax fibre, tex 210, 223 turns/m, weft density: 10 threads/cm, warp density: 5 threads/cm	Epoxy resin Araldite MY-750/HY 932	Dried overnight at 50	Hand lay-up with vacuum consolidation	Hand lay-up	5	28		[46]
Biaxial weft knitted flax yarns Average twist : 185 turns/m and 350 Tex	Unsaturated polymer resin 4802 supplied by Fiber Glass international	No treatment	Vacuum assisted resin transfer moulding process (VARTM)	RTM	6	33.7		[47]
FUD115 prepreg made of flax fibre with an areal weight of 115g/m^2 and 1/8 weft/wrap ratio provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		Prepreg cured in a hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C	Hot press		46		[19]
UD flax tow woven fabrics (FRD-UD41) with an areal density of 218 g/m^2 provided by Fibre Recherche Developpement (FRD, France). The relative amount of flax yarns in the weft and warp direction are 84 and 16 wt%, respectively	An infusion epoxy resin Resoltech 1800 and Resoltech 1805 aliphatic amine hardener provided by Resoltech (France)	Untreated Fibres were dried at 60°C for 24h	Plies impregnated and hot pressed at 50 bars, 60°C during 21h (curing 6h and post curing 15h	Hot Press		44.2	1.4	[48]
PULTRUSION								

Fibres	Resin	Treatment	Manufacture	Classified as:	No of spec.	Vf (%)		Ref.
UD Hackled flax fibres type Aramis from Terre de Lin company (France) dew-retted in 2013	Epoxy RIM 135 with RIMH 137i hardener provided by Lange+Ritter GmbH	Fibres pre-dried for 24 h at 60°C	Pultrusion	Pultrusion	6	29	1	[13]
Bundles of long UD flax fibres Manually hackled fibres and non-hackled (scotched) fibres	Epoxy resin Araldite MY-750/HY 932	Dried overnight at 50°C	Lab scale pultrusion set up	Pultrusion		25		[46]

2. Tensile Longitudinal properties UD

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
HAND LAY-UP						Mean	COV (%)	Mean	COV	Mean	SD	
UD fabric provided by Libeco Lagae composed of flax yarns linked with a few yarns in the 90° direction	Epoxy resin SR1500 and hardener SD2503 provided by Sicomin	"Dry" yarns were dried at 103°C ± 3°C to constant mass	Hand lay-up pressed with a vacuum bag at 950 mbar and cured at ambient temperature	5	32.8±1.3	22.9	4.80					[1]
UD fabric provided by Libeco Lagae composed of flax yarns linked with a few yarns in the 90° direction	Epoxy resin SR1500 and hardener SD2503 provided by Sicomin	"Wet" yarns were stored in a regulated chamber (23 ± 2°C and 55 ± 5% relative humidity) until	Hand lay-up pressed with a vacuum bag at 950 mbar and cured at ambient temperature	5	37.4±0.7	21.4	3.74					[1]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
		equilibrium is reached										
UD flax fibres reinforcement made of 200 tex yarns supplied by Safilin Inc. with an areal weight of 180 g/m^2	Adtech 820 Epoxy resin	Chemically treated to improve the fibre-matrix interface	Hand impregnation with a roller followed by curing under vacuum Post cure at 75°C for 16 hours	5	33.5	15.9701	8.44	153.6	9.83			[2]
compression mould												
UD Flax fibres (marylin variety)	Epoxy resin (Axson, Epolam 2020)	As received	Compression moulding	10	54 (3)	34	8.82	364	3.85	1.3	0.01	[3]
Flax fibres (Andrea variety) UD	Epoxy resin (Axson, Epolam 2020)	As received	Compression moulding	10	51 (4)	28	12.86	290	7.59	1.1	0.15	[3]
Flax fibres (Hermes variety) UD	Epoxy resin (Axson, Epolam 2020)	As received	Compression moulding	10	51 (2)	26	7.69	408	8.82	1.3	0.05	[3]
Flax fibres from middle section of flax long tows of the Hermes variety cultivated in 2002 UD manually aligned technical fibres	Epoxy resin (Axson 2015)	As received	Wet impregnation prior to compression moulding	5	20.1	16.7	22.16	127	11.02	0.9	0.2	[4]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
Flax fibres from top section of flax long tows of the Hermes variety cultivated in 2002 UD manually aligned technical fibres	Epoxy resin (Axson 2015)	As received	Wet impregnation prior to compression moulding	5	19.7	12.4	10.48	126	11.11	1.3	0.2	[4]
Flax fibres from bottom section of flax long tows of the Hermes variety cultivated in 2002 UD manually aligned technical fibres	Epoxy resin (Axson 2015)	As received	Wet impregnation prior to compression moulding	5	19.8	11.1	12.61	113	9.73	1.5	0.1	[4]
UD Flax fibres, Ariane Variety cultivated in Normandy (France)	Epoxy resin (Axson 2020)	As received	Compression moulding	10	40.4 (1.2)	22.50	6.71	328	5.49	1.6	0.2	[6]
UD Flax bundles from the Silsoe Research Institute, mechanically decorticated	Low viscosity epoxy system S.P. Systems Ampreg 26	No treatment	Hand lay-up cured under vacuum with a steel top	5	0.49 (0.01)	11.86	14.25	118.5	5.09			[5]
UD flax fibres provided by Terre de Lin (France) from the Eden variety extracted from the top of the stem (h=62.5 cm)	Epolam 2020 resin		Compression moulding	5	60±2	36.1	13.85	270	14.81	0.9	0.1	[9]
UD flax fibres provided by Terre de Lin (France) from the Eden variety extracted	Epolam 2020 resin		Compression moulding	5	60±2	40.1	9.48	307	9.45	0.9	0.1	[9]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
from the middle of the stem (h=35 cm)												
UD flax fibres provided by Terre de Lin (France) from the Eden variety extracted from the bottom of the stem (h=12.5 cm)	Epolam 2020 resin		Compression moulding	5	60±2	33.6	16.37	196	27.55	0.7	0.2	[9]
Scutched UD flax fibres	Epoxy resin Epolam 2020, Axson technologies	As received	Wet impregnation and compression moulding	7	65±3.3	33.6	12.20	353	3.40	1.2	0.1	[10]
UD flax tows	Epoxy resin Epolam 2020, Axson technologies	Manually untangled and aligned	Wet impregnation and compression moulding	7	62±2.7	28.6	7.69	331	7.25	1.2	0.1	[10]
HOT PRESS												
UD fabric, twisted flax-fibre yarn coming from wet spinning 180g/m^2	Epoxy resin Araldite LY 5150 resin and Aradur 5021/XB3471 hardener from Huntsman	No treatment	Hot platen press process with prepregs	5	44	26.6	N/A			1.56	0.13	[14]
UD Hermes Flax fibres 140g/m^2	Epoxy resin SR 8200/SD 8205 supplied by Sicomin	Used as received	Hand lay-up followed by hot platen curing (60°C for 8hrs)	5	43.9 (1.5)	22.8	4.39	318	3.77	1.65	0.05	[15] [17] For stress

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
												only
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with 40 strands in the 0° direction and 3 across within a unit square	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2h at 150°C	4	49.6±2.3	31.0				1.6		[11]
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with a ratio of 0°-90° fibres of 40:3	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2.5 bar followed by 2h at 150°C and 5 bar	3	50.97 (3.92)	31.42	4.68	286.70	4.64	1.53	0.07	[12]
UD flax fabrics composed of parallel aligned twisted yarns in 0 direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2	Epoxy resin 618(E-51) based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent	UD fabric was dried in an oven at 120°C for 2 hours	Hand lay-up to produce prepreg and hot press machine Temp. to apply		45	22.25	5.80	172.08	10.28			[18]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
provided by Lone company Belgium	and accelerating agent (MeTHPA0 and DMP-30) were purchased Shanghai Zhongsi Industry Co., Ltd., China		pressure= 90°C Time to apply pressure= 30 min Pressure= 0.50 MPa									
UD flax fabrics composed of parallel aligned twisted yarns in 0° direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2 provided by Lone company Belgium	Epoxy resin 618(E-51) based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent and accelerating agent (MeTHPA0 and DMP-30) were purchased Shanghai Zhongsi Industry Co., Ltd., China	UD fabric was dried in an oven at 120°C for 2 hours	Hand lay-up to produce prepreg and hot press machine Temp. to apply pressure= 90°C Time to apply pressure= 30 min Pressure= 1 Mpa		45	22.67	2.07	205.56	3.96			[18]
UD flax fabrics composed of parallel	Epoxy resin 618(E-51)	UD fabric was dried in an	Hand lay-up to produce		45	23.52	1.28	218.45	3.60			[18]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
aligned twisted yarns in 0° direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2 provided by Lone company Belgium	based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent and accelerating agent (MeTHPA0 and DMP-30) were purchased Shanghai Zhongsi Industry Co., Ltd., China	oven at 120°C for 2 hours	prepreg and hot press machine Temp. to apply pressure= 90°C Time to apply pressure= 30 min Pressure= 1.5 MPa									
UD flax fabrics composed of parallel aligned twisted yarns in 0 direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2 provided by Lone company Belgium	Epoxy resin 618(E-51) based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent and accelerating agent (MeTHPA0 and DMP-30) were purchased	UD fabric was dried in an oven at 120°C for 2 hours	Hand lay-up to produce prepreg and hot press machine Temp. to apply pressure= 90°C Time to apply pressure= 20 min		45	22.38	2.28	183.52	5.13			[18]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	Shanghai Zhongsi Industry Co., Ltd., China		Pressure= 1 MPa									
UD flax fabrics composed of parallel aligned twisted yarns in 0° direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2 provided by Lone company Belgium	Epoxy resin 618(E-51) based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent and accelerating agent (MeTHPA0 and DMP-30) were purchased Shanghai Zhongsi Industry Co., Ltd., China	UD fabric was dried in an oven at 120°C for 2 hours	Hand lay-up to produce prepreg and hot press machine Temp. to apply pressure= 90°C Time to apply pressure= 40 min Pressure= 1 Mpa		45	22.27	1.89	173.11	7.49			[18]
UD flax fabrics composed of parallel aligned twisted yarns in 0 direction and linked with a few yarns in the 90° direction with an areal weight of 200g/m^2	Epoxy resin 618(E-51) based on the bisphenol-A was supplied by Nanya, Taiwan. The curing agent and	UD fabric was dried in an oven at 120°C for 2 hours	Hand lay-up to produce prepreg and hot press machine Temp. to apply		45	22.12	5.47	196.21	4.96			[18]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
provided by Lone company Belgium	accelerating agent (MeTHPA0 and DMP-30) were purchased Shanghai Zhongsi Industry Co., Ltd., China		pressure= 100°C Time to apply pressure= 20 min Pressure= 1 MPa									
UD380 prepreg made of flax fibre with an areal weight of 400g/m^2 provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		Prepreg cured in a hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C	5	57	26.3	7.98	260	10.38	1.58	0.11	[19]
UD200 prepreg made of flax fibre with an areal weight of 223g/m^2 provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		Prepreg cured in a hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C	4	60	27.5	10.55	298	6.71	1.69	0.09	[19]
FUD180 prepreg made of flax fibre	Standard Epoxy for		Prepreg cured in a	5	64	33.6	4.46	331	8.76	1.64	0.13	[19]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
with an areal weight of 180g/m^2 and 1/19 weft/warp ratio provided by Lineo	prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C									
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	5	46.1	31.6	3.04	311	4.47	1.50	0.12	[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	3	45.6	30.4	8.88	319	6.27	1.59	0.14	[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	3-6 Assumed as 3	45	32.9	9.60	327	3.00	1.45	0.15	[21]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C		51.0±1.4	29.7	1.68	350	11.14			[22]
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C		51.1±1.4	29.2	3.42	316	12.03			[22]
Resin infusion												
UD Flaxtape supplied by Lineo	Epoxy resin (Epikote 828 LV and Dytek	No Treatment	Vacuum Assisted Resin	X	40	23.9	7.95	222.9	2.74	X	X	[25]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	DCH-99 hardener)		Infusion (VARI)									
Flax yarn processed in UD mats provided by Composites Evolution (UK)	Low-viscosity Epoxy Prime 20LV By Gurit	Cellulose based binder	Vacuum infusion	6	26.9 (0.1)	14.2	2.11	163.5	1.83	1.8	0.1	[26]
Flax yarn processed in UD mats provided by Safilin (Fr)	Low-viscosity Epoxy Prime 20LV by Gurit	Cellulose based binder	Vacuum infusion	6	29.9 (0.1)	24.6	1.63	281.4	1.35	1.8	0.1	[26]
Individual flax fibres	Epoxy resin Axson 2015		Bag moulding under vaccum		40	24.6	2.03					[24]
Quasi unidirectional flax fabrics UD 360 with an areal weight of 360 g/m^2 with 330 g/m^2 in the weft direction and 30 g/m^2 in the warp direction provided by Fibres Recherche Developpement (Troyes, France)	Epoxy resin DER 332 provided by Dow Chemicals (Midland, USA) and hardener IPDA provided by Sigma Aldrich (Saint-Louis, USA)		Vacuum infusion at 50% RH and 23°C and then cured at 80°C for 24h No post curing	4	30	17.9	3.80	252		1.64		[27]
Quasi unidirectional flax fabrics UD 360 with an areal weight of 360 g/m^2 with 330	Epoxy resin DER 332 provided by Dow		Vacuum infusion at 50% RH and 23°C and	4	30	22.2	9.82	136		0.74		[27]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
g/m^2 in the weft direction and 30 g/m^2 in the warp direction provided by Fibres Recherche Developpement (Troyes, France)	Chemicals (Midland, USA) and hardener IPDA provided by Sigma Aldrich (Saint-Louis, USA)		then cured at 80°C for 24h Post curing at 150°C for 2 hours									
UD flax fibres with an areal weight of 180g/m^2	Epoxy system consisting of an EPIKOTE MGS RIMR 235 resin and RIMH 236 hardener		Resin infusion	3		19	5.26	165	3.64			[49]
UD FlaxTape 200g/m2 manufactured by Lineo	Elium RT 150 manufactured by ARKEMA	Water mist and dried for one hour at 110°C	Resin infusion	5	35-40	23.3	4.98	225	3.93			[45]
Unidirectional non-crimp flax yarn fabric Amplitex 5008 with an areal weight of 350 g/m^2 from BComp Ltd., Switzerland	Huntsmans Araldite 1568 / Aradur 3489 epoxy resin		Vacuum infusion Cured for 19hrs at 40°C and 5 hours at 75°C	10	37	20.3	7.39	269	10.04			[29]
Autoclave /Prepreg												

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
UD flax fibres, Arianne, 1996, supplied by Tex-Dem N.V., Alveringem, Belgium	Epoxy HM533 supplied by Hexcel Composites	Untreated	Film stacking cured in autoclave under vacuum 1h at 3 bar and 125°C		40	26	3.85	190	5.26			[30]
UD Fine flax roving (slightly twisted fibre slivers) supplied by Tex-Dem N.V., Alveringem, Belgium	Two parts epoxy system (resin LMB 6305 and hardener HY 5021 BD) manufactured by Vantico N.V., Belgium	Untreated	Drumwinder to manufacture prepreg reinforcements cured in an autoclave for 1h at 3 bar and 125°C		48	32	3.13	268	9.70			[30]
UD Flax fibres (Arianne variety, 1996)	Epoxy resin film HM 533 from Hexcel	Untreated	Cured in an autoclave		40	28	N/A	133	N/A			[31]
Hackled flax fibres from Terre de Lin (France) 30000 tex	Epoxy resin XB 3515/Aradur 5021 from Huntsman	No treatment	Prepreg and autoclave		42 (±2)	28.2	9.22	378	10.05			[32]
Roving flax fibres from Safilin 280 tex	Epoxy resin XB 3515/Aradur 5021 from Huntsman	No treatment	Drumwinder and autoclave		48(+-1)	26.2	6.11	377	6.37			[32]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
Flax yarns from Safilin 83.3 tex	Epoxy resin XB 3515/Aradur 5021 from Huntsman	No treatment	Drumwinder and autoclave		50 (+-1)	23.1	5.19	315	14.60			[32]
UD Flax/epoxy prepreg purchased from LINEO (Belgium)	Partially cured epoxy resin system (Huntsman LY5150)	Flax fibres treated by a patented sizing and drying process (US Patent No.8080288)	Prepreg cured in autoclave	3	50% by weight			304				[50]
Quasi-UD woven flax epoxy prepreg with aerial density of reinforcement 170g/m^2 and 95.5% of flax fibres in the warp direction provided by LINEO (Belgium)	Epoxy resin (prepreg system Araldite LY5150/ Aradur 1571/ Accelerator 1573 / Hardener XB3471)	No treatment	Prepreg and autoclave	3	47 (±2)	27.2	1.91	296	0.17	1.65	0.055	[34]
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa		36.4±0.9	22.3	3.14	266	11.65			[22]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	Company for prepreg		External pressure= 300 kPa									
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa External pressure=300 kPa		44.0±1.1	26.6	1.88	274	11.31			[22]
RTM												
Unidirectional biotechnically retted flax fibres "ArticFlax" grown in Finland and provided by FinFlax Oy	Epoxy resin XB 5082 with hardener HY5983 from Ciba	As received	RTM	5	47	39	15.38	279	5.02	0.8		[36]
Unidirectional retted flax fibres provided by Muhlmeier GmbH	Epoxy resin XB 5082 with hardener HY5983 from Ciba	As received	RTM	5	32	15	4.00	132	3.41	1.2		[36] [37]
UD flax fabrics "FlaxPly E-UD" with an aeral weight of 180g/m^2 purchased from LINEO, Belgium	Epoxy resin L-235 with a hardener Epoxy-Härter 236	Fibres used as received	RTM	3	40	20.2	9.90	258.8	1.20			[38]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	purchased from Swiss-Composite											
Quasi UD flax fibres with 90% of fibres in 0° direction and 10% in the 90° direction with an areal weight of 300 g/m^2 supplied by B-Comp	Epoxy resin Epikote 828LVEL and hardener Dytek DCH-99	Dry spun	RTM	5	40	22.9	2.18	235	12.77			[39]
UD flax fibres orientated at 0° with a areal weight of 200 g/m^2 supplied by Lineo	Epoxy resin Epikote 828LVEL and hardener Dytek DCH-99	Water treated	RTM	5	40	26.6	8.65	249	3.78			[39]
UD flax fabrics FLAXPLY with an areal weight of 180 g/m^2 provided by Lineo	SR-8100 Epoxy resin produced by Sicomin	Fibres were dried at 60°C for 6 h before infusion	Vacuum Assisted Resin Transfer Moulding (VARTM) 24h at ambient temperature and post cured for 8h at 60°C under a 80 kPa vacuum	40	31	18.6	5.38	283.4	4.59	1.87	0.09	[41]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
UD flax reinforcement with an areal density of 400g/m^2 made of untreated twisted flax yarns (Tex 1000) supplied by Safilin	820 epoxy /824 hardener system supplied by Adtech Plastic	No treatment	Resin transfer moulding	5	40	30.24	9.36	329.23	6.15			[43]
Unidirectional flax fibre fabric "Biotex Flax" manufactured by Composites Evolution Ltd., UK.	Epoxy resin system Araldite LY 8601 mixed with Aradur 8602 hardener produced by Huntsman Corporation	Fibres were placed to an oven at 80°C for 24h to dry prior to infusion	Vacuum assisted resin transfer moulding (VARTM) Post cured at 80°C for 24h	5	38	-	15	-	28			[44]
DISCARDED												
UD warp knitted flax fibres 185 g/m^2 , weft yarn: long flax fibre, tex 210, 223 turns/m, weft density: 10 threads/cm, warp density: 5 threads/cm	Epoxy resin Araldite MY-750/HY 932	Dried overnight at 50	Hand lay-up with vacuum consolidation	5	28	15		160				[46]
Biaxial weft knitted flax yarns Average twist : 185 turns/m and 350 Tex	Unsaturated polymer resin 4802 supplied by Fiber Glass	No treatment	Vacuum assisted resin transfer molding process (VARTM)	6	33.7	3.9		128.3		5.6		[47]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	international (????)											
Long unidirectional hackled flax fibres with an aeral weight of 250 g/m^2 provided by Terre de Lin	Epikote 828 LVEL epoxy resin and NOVACARD XRF-1400 bio-based novalac hardener	No treatment	Vacuum infusion			20-21						[51]
Flax UD prepreg (Ribs 4/4-unidirectional)with aeral weight 190 g/m^2 supplied by Lineo, Belgium	Epoxy		Prepreg placed between steel mould plates heated at maximum 130°C	5	By weight	2.9	0.13	126.30	0.09	4.07	0.008 95	[52]
FUD115 prepreg made of flax fibre with an areal weight of 115g/m^2 and 1/8 weft/wrap ratio provided by Lineo	Standard Epoxy for prepregs: Araldite LY5150/Aradur 5021/Hardener XB 3471 provided by Hunstman		Prepreg cured in a hot press composed of a male and female mould for 30 min at 80°C and 60 min at 130°C	5	46	23.1	6.06	235	6.81	1.51	0.12	[19]
Pultrusion												
UD Flax (JS-33-1995, Cebeco, NL)	Epoxy Ampreg 20 from SP	None	Pultrusion on a lab scale set-up	3	By weight	23.3	14.16	249	10.04			[53]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	Systems with ultra-slow harder											

3. Tensile Transverse properties UD

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
						Mean	CoV (%)	Mean	CoV	Mean	SD	
UD Hermes Flax fibres 140g/m^2	Epoxy resin SR 8200/SD 8205 supplied by Sicomin	Used as received	Hand lay-up followed by hot platen curing (60°C for 8hrs)	5	43.9 (1.5)	4.52	3.98	26.1	2.30	0.622	0.036	[15]
UD FlaxTape 200g/m^2 manufactured by Lineo	Elium RT 150 manufactured by ARKEMA	Water mist and dried for one hour at 110°C	Resin infusion	5	35-40	3.22	3.73	7.51	3.86	00	00	[45]
UD flax fibres, Arianne, 1996, supplied by Tex-Dem N.V., Alveringem, Belgium	Epoxy HM533 supplied by Hexcel Composites	Untreated	Film stacking cured in autoclave under vacuum 1h at 3 bar and 125°C		40	4.0	12.50	10	10.00			[30]
UD flax fibres roving supplied by Tex-Dem N.V., Alveringem, Belgium	Two-part epoxy system (LMB 6305 and hardener HY 5021 BD)		Prepreg manufactured with drumwinder and cured in autoclave for		48	4.0	7.50	18	5.56			[30]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
	Manufactured by Vantico N.V-, Belgium		1h at 3 bar and 125°C									
UD Flax fibres (Arianne variety, 1996)	Epoxy resin film HM 533 from Hexcel	Untreated	Cured in an autoclave		40	2.7		4.5				[31]
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with 40 strands in the 0° direction and 3 across within a unit square	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2h at 150°C	4	49.6±2.3	4.6						[11]
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with a ratio of 0°-90° fibres of 40:3	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2.5 bar followed by 2h at 150°C and 5 bar	3	50.97 (3.92)	5.58	8.96	33.86	3.99	1.36	0.18	[12]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg	Epoxy resin Huntsman LY 5150		Prepreg and thermos-	5	46.1	4.71	7.01	31.2	2.69	0.96	0.08	[21]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight			compression process									
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	5	45.6	4.69	15.78	30.0	4.33	0.99	0.16	[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	3-6 Assumed 3	45	4.80	5.21	27.7	1.08	1.0	0.15	[21]
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press		51.0±1.4	4.8	4.17	34.8	1.44			[22]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
			Curing: 30 min at 80°C and 60 min at 130°C									
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C		51.1±1.4	4.7	6.38	30.0	1.33			[22]
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa External pressure= 300 kPa		36.4±0.9	4.2	2.38	35.8	1.96			[22]
Prepreg made of quasi UD fabric FUD180	Araldite LY5150 and	Leaching pre-treatment	Laminates cured in an		44.0±1.1	4.2	4.76	32.0	5.31			[22]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg		autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa External pressure=300 kPa									
UD flax reinforcement with an areal density of 400g/m2 made of untreated twisted flax yarns (Tex 1000) supplied by Safilin	820 epoxy /824 hardener system supplied by Adtech Plastic	No treatment	Resin transfer moulding	5	40	3.06	6.21	36.53	30.91			[43]
UD flax fibres with an areal weight of 180g/m^2	Epoxy system consisting of an EPIKOTE MGS RIMR 235 resin and RIMH 236 hardener		Resin infusion	3		4		18	5.56			[49]
Unidirectional non-crimp flax yarn fabric Amplitex 5008 with an areal weight of 350 g/m^2 from BComp Ltd., Switzerland	Huntsmans Araldite 1568 / Aradur 3489 epoxy resin		Vacuum infusion Cured for 19hrs at 40°C	3	37	3.6	5.56	21	4.76			[29]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Young's modulus		Strength		Strain		Ref.
			and 5 hours at 75°C									
DISCARDED												
UD flax tow woven fabrics (FRD-UD41) with an areal density of 218 g/m^2 provided by Fibre Recherche Developpement (FRD, France). The relative amount of flax yarns in the weft and warp direction are 84 and 16 wt%, respectively	An infusion epoxy resin Resoltech 1800 and Resoltech 1805 aliphatic amine hardener provided by Resoltech (France)	Untreated Fibres were dried at 60°C for 24h	Plies impregnated and hot pressed at 50 bars, 60°C during 21h (curing 6h and post curing 15h	5	44.2±1.4	4.642	2.07	38.8	6.96	2.9	6.90	[48]

4. Compressive longitudinal properties UD

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Compressive modulus (GPa)		Compressive Strength (MPa)		Strain (%)		Ref.
						Mean	STDEV	Mean	CoV	Mean	STDEV	
UD Flaxtape supplied by Lineo	Epoxy resin (Epikote 828 LV and Dytek DCH-99 hardener)	No Treatment	Vacuum Assisted Resin Infusion (VARI)	X	40	15.1	2.5	136.9	4.02			[25]
UD Hermes Flax fibres 140g/m^2	Epoxy resin SR 8200/SD 8205	Used as received	Hand lay-up followed by hot platen	5	43.9 (1.5)	24.7	0.6	136	1.47	2.41	0.27	[15]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Compressive modulus (GPa)		Compressive Strength (MPa)		Strain (%)		Ref.
	supplied by Sicomin		curing (60°C for 8hrs)									
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with a ratio of 0°-90° fibres of 40:3	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2.5 bar followed by 2h at 150°C and 5 bar	3	50.97 (3.92)	30.32	3.04	127.11	4.00	1.60	0.29	[12]
Unidirectional non-crimp flax yarn fabric Amplitex 5008 with an areal weight of 350 g/m^2 from BComp Ltd., Switzerland	Huntsmans Araldite 1568 / Aradur 3489 epoxy resin		Vacuum infusion Cured for 19hrs at 40°C and 5 hours at 75°C	3	37	16.2	0.4	110	0			[29]
DISCARDED												
UD Flax (JS-33-1995, Cebeco, NL)	Epoxy Ampreg 20 from SP Systems with ultra-slow harder	None	Pultrusion on a lab scale set-up	3 for sigma 1 for E	By weight	30		119	1.68			[53]

5. Compressive transverse properties UD

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Compressive modulus (GPa)		Compressive Strength (Mpa)		Compressive Strain (%)		Ref.
						Mean	STDEV	Mean	CoV	Mean	SD	
UD Hermes Flax fibres 140g/m^2	Epoxy resin SR 8200/SD 8205 supplied by Sicomin	Used as received	Hand lay-up followed by hot platen curing (60°C for 8hrs)	5	43.9 (1.5)	5.93	0.27	100	4	3.27	0.12	[15]
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with a ratio of 0°-90° fibres of 40:3	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2.5 bar followed by 2h at 150°C and 5 bar	3	50.97 (3.92)	5.70	0.71	79.94	12.45	2.61	0.53	[12]
Unidirectional non-crimp flax yarn fabric Amplitex 5008 with an areal weight of 350 g/m^2 from BComp Ltd., Switzerland	Huntsmans Araldite 1568 / Aradur 3489 epoxy resin		Vacuum infusion Cured for 19hrs at 40°C and 5 hours at 75°C	2	37	4.5	0.6	76	6.58			[29]

6. Shear modulus and Poisson's ratio

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
							cov		Cov(%)		CoV		**SD**	
UD Hermes Flax fibres 140g/m^2	Epoxy resin SR 8200/SD 8205 supplied by Sicomin	Used as received	Hand lay-up followed by hot platen curing (60°C for 8hrs)	5	43.9 (1.5)	0.434	19.35	1.96	8.67	39.7	8.31	6.23	1.08	[15]
100% flax fibres in longitudinal direction (scotched and hackled) with an aeral weight of 200g/m^2 FlaxTape from Lineo	Epoxy resin 2020 from Axson	No treatment	Stacks were impregnated with resin in a wet-lay process and compressed at 50 bars using a press at ambient temperature		65					32.0	6.03	0.029	0.003	[7]
UD FlaxTape 200g/m^2 manufactured by Lineo	Elium RT 150 manufactured by ARKEMA	Water mist and dried for one hour at 110°C	Resin infusion	5	35-40	0.35	2.86	1.53	10.46	17.7	12.03	00	00	[45]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
Quasi-UD woven flax epoxy prepreg with aerial density of reinforcement 170g/m^2 and 95.5% of flax fibres in the warp direction provided by LINEO (Belgium)	Epoxy resin (prepreg system Araldite LY5150/ Aradur 1571/ Accelerator 1573 / Hardener XB3471)	No treatment	Prepreg and autoclave	3	47 ±2	0.409	8.31							[34]
UD dry flax fibres of the Hermes variety cultivated in northern France by CRST [±45] lay-up	SR 8200 resin and SD 8205 hardener supplied by Sicomin	No treatment	Manually impregnated before being placed in compression moulding machine with heated plates 4 plies, 3.8 bars	3	37.2(0.4)			2.10	4.29	37.9	3.96	3.8	0.9	[54]
UD dry flax fibres of the Hermes variety cultivated in northern France	SR 8200 resin and SD 8205 hardener	No treatment	Manually impregnated before being placed in	3	37.7(0.5)			2.07	2.90	45.6	4.17	4.7	0.1	[54]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
by CRST [±45] lay-up	supplied by Sicomin		compression moulding machine with heated plates 8 plies, 3.8 bars											
UD dry flax fibres of the Hermes variety cultivated in northern France by CRST [±45] lay-up	SR 8200 resin and SD 8205 hardener supplied by Sicomin	No treatment	Manually impregnated before being placed in compression moulding machine with heated plates 6 plies, 5.9 bars	3	42.0 (0.8)			2.34	7.26	43.5	2.99	4.0	0.8	[54]
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with 40 strands in the 0° direction and	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman	No treatment	Hand lay-up followed by a heated platen press consolidation for	4	49.6 ±2.3	0.353		2.0						[11]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
3 across within a unit square	Corporation, USA)		15 min at 120°C and 2h at 150°C											
UD FlaxPly (Lineo) 150g/m^2 The fabric architecture is predominantly UD with a ratio of 0°-90° fibres of 40:3	Hot-curing epoxy resin Araldite LY 1564 and hardener Aradur 22962 (Huntsman Corporation, USA)	No treatment	Hand lay-up followed by a heated platen press consolidation for 15 min at 120°C and 2.5 bar followed by 2h at 150°C and 5 bar	3	49.79 (2.33)	0.353	3.12	2.07	6.28	37.35	4.77	14.92	2.57	[12]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	5	46.1	0.36	5.56							[21]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	3	45.6	0.34	5.88							[21]
Flax fibres prepreg with an aeral weight of 154g/m^2: FlaxPreg UD 150 supplied by Lineo, France. The fabric contains 95% of wrap yarns and 5% of weft yarns by weight	Epoxy resin Huntsman LY 5150		Prepreg and thermos-compression process	3-6	45	0.36	5.56							[21]
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in	Araldite LY5150 and Aradur 5021 hardener with an accelerator	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured		51.0 ±1.4	0.36	2.78	2.19	7.31					[22]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
the warp direction provided by Lineo	XB 3471 developed by Huntsman Company for prepreg		between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C											
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Hot platen press process with layers of fabrics stacked and cured between two heated platen press Curing: 30 min at 80°C and 60 min at 130°C		51.1 ±1.4	0.37	2.70	1.86	9.14					[22]
Prepreg made of quasi UD fabric FUD150 with an areal weight of 145 g/m^2 with 96 % of the yarns in the warp	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum		36.4 ±0.9	0.35	2.86	1.97	9.64					[22]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
direction provided by Lineo	developed by Huntsman Company for prepreg		pressure = 2 kPa External pressure= 300 kPa											
Prepreg made of quasi UD fabric FUD180 with an areal weight of 164 g/m^2 with 93 % of the yarns in the warp direction provided by Lineo	Araldite LY5150 and Aradur 5021 hardener with an accelerator XB 3471 developed by Huntsman Company for prepreg	Leaching pre-treatment	Laminates cured in an autoclave at 120°C for 150 min Applied vacuum pressure = 2 kPa External pressure=300 kPa		44.0 ±1.1	0.36	8.33	1.89	5.29					[22]
Unidirectional reinforcement made of 100% flax fibres in the longitudinal direction with an areal weight of 200g/m^2 (Flax Tape from Lineo)	Epoxy resin Epolam 2020 from Axson	No treatment on the fibre surface	Each ply was impregnated in a wet lay-up process and stacked in a female mould. The plies were compressed using a	5	60	0.444								[8]

Fibres	Resin	Treatment	Manufacture	No of spec.	Vf (%)	Poisson's ratio		Shear modulus (GPa)		Shear strength (MPa)		Shear Strain (%)		REF
			press by the male mould with 50 bar pressure Curing for 24 hours at 25°C and post curing 3h at 40°C, 2h at 60°C, 2h at 80°C and 8h at 100°C											

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