

복합재료(Composite+PE) 물성 DB (200개)

○ 시험 개요

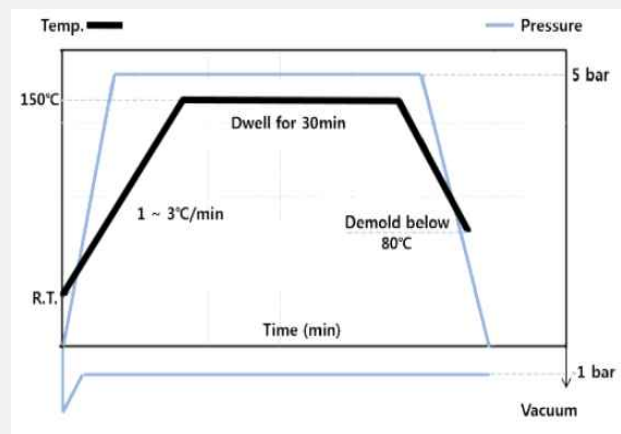
탄소섬유 강화 복합재료에 대한 시뮬레이션 물성 라이브러리를 구축하기 위해, 다양한 복합구조체의 섬유 방향과 적층수와 수지 종류에 따른 재료 물성 차이를 조사하고, 이에 따른 결과를 데이터 베이스(Data Base, DB) 구축하는 것이 목적임.

○ 시험규격 (ASTM D3039, ASTM D695, ASTM D5379)

시험 장비는 20톤 용량의 Shimadzu사 만능재료시험기를 사용하여 재료 물성을 평가하였으며, 하중 변위 속도는 분당 2mm의 변위제어 속도로 최대 하중의 50% 하중 저하가 발생하면 자동으로 종료되도록 설정함.

○ 성형 조건 및 시험 환경

시험환경은 대기온도 25℃, 습도 20%에서 시험.



<성형조건>

○ 시험장비(만능재료시험기)

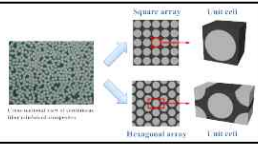


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Data base report of material properties library for polymer composite engineering

Theory

Representative elementary volume (REV) is the smallest volume over which a measurement can be made that will yield a value representative of the whole. In the case of periodic materials, one simply chooses a periodic unit cell (which, however, may be non-unique), but in random media, the situation is much more complicated.



Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 110
Fiber material	Carbon	Poisson's ratio	- 0.27
Lay up type	Multi layer	Density	g/mm ³ 1.88

Resin		Material properties	
Type	PE	Property	Unit Value
		E-Modulus	MPa 323
		Poisson's ratio	- 0.26
		Density	g/mm ³ 1.69

Property according to direction(XYZ)

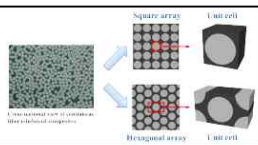
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.773E-09	-
2	E ₁	Young's Modulus X	MPa	149388.8	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	10893.12	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	11074.672	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.581862	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.4757115	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.302325	-
8	G ₁₂	Shear Modulus XY	MPa	3648.848	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4039.796	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4050.913	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	5006.859	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4096.521	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3431.358	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-403.0484	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	367.6455	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-408.495	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	140.8392	-
18	S _{33T}	Shear strength	MPa	169.2342	-
19	k	Thermal conductivity	W/m·K	458.5275	-
20	C _p	Specific heat	kJ/kg·K	424.05	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 105
Fiber material	Carbon	Poisson's ratio	- 0.26
Lay up type	Multi layer	Density	g/mm ³ 1.85

Resin		Material properties	
Type	PE	Property	Unit Value
		E-Modulus	MPa 316
		Poisson's ratio	- 0.29
		Density	g/mm ³ 1.87

Property according to direction(XYZ)

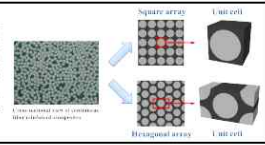
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	2.002E-09	-
2	E ₁	Young's Modulus X	MPa	140052	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	13071.744	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	10166.912	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.577905	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.39315	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.3192552	-
8	G ₁₂	Shear Modulus XY	MPa	4365.586	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4333.007	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4050.913	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	3851.43	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3991.482	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	2941.164	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-285.9465	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	389.4319	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-313.1795	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	153.333	-
18	S _{33T}	Shear strength	MPa	152.8886	-
19	k	Thermal conductivity	W/m·K	427.959	-
20	C _p	Specific heat	kJ/kg·K	508.86	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 102
Fiber material	Carbon	Poisson's ratio	- 0.27
Lay up type	Multi layer	Density	g/mm ³ 1.61

Resin		Material properties	
Type	PE	Property	Unit Value
		E-Modulus	GPa 365
		Poisson's ratio	- 0.27
		Density	g/mm ³ 1.55

Property according to direction(XYZ)

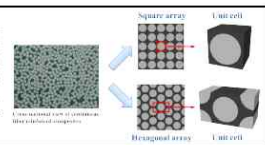
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.887E-09	-
2	E ₁	Young's Modulus X	MPa	123712.6	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	13253.296	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	11800.88	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.5543415	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.566136	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.3482784	-
8	G ₁₂	Shear Modulus XY	MPa	3583.69	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3616.269	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	5262.401	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	4306.599	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4341.612	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	2941.164	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-367.6455	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	362.1989	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-285.9465	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	130.617	-
18	S _{33T}	Shear strength	MPa	147.654	-
19	k	Thermal conductivity	W/m·K	380.408	-
20	C _p	Specific heat	kJ/kg·K	424.05	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 123
Fiber material	Carbon	Poisson's ratio	- 0.26
Lay up type	Multi layer	Density	g/mm ³ 1.56

Resin		Material properties	
Type	PE	Property	Unit Value
		E-Modulus	GPa 342
		Poisson's ratio	- 0.27
		Density	g/mm ³ 1.87

Property according to direction(XYZ)

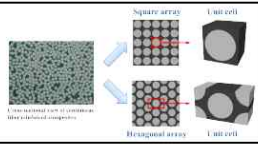
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.630E-09	-
2	E ₁	Young's Modulus X	MPa	13650.7	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	10166.912	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	11710.104	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.456054	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.4285335	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.2515344	-
8	G ₁₂	Shear Modulus XY	MPa	4333.007	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3616.269	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4013.054	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	3606.339	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3606.339	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3050.096	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-348.5824	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	392.1552	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-403.0484	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	169.2342	-
18	S _{33T}	Shear strength	MPa	155.6046	-
19	k	Thermal conductivity	W/m·K	478.9065	-
20	C _p	Specific heat	kJ/kg·K	539.7	-

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Material properties

Weave

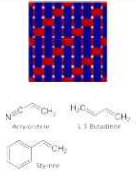
Brand	SK Chemical
Pattern	Woven
Fiber material	Carbon
Lay up type	Multi layer

Resin

Type	PE
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Material properties

Property	Unit	Value
E-Modulus	GPa	102
Poisson's ratio	-	0.29
Density	g/mm ³	1.9



Property according to direction(XYZ)

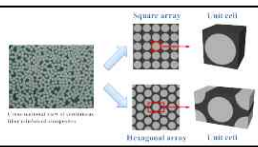
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.444E-09	-
2	E ₁	Young's Modulus X	MPa	164561.1	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	11165.448	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	10620.792	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.39315	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.479643	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.326511	-
8	G ₁₂	Shear Modulus XY	MPa	3974.638	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3746.585	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	5375.978	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	4516.677	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4971.846	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	4003.251	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-3451.358	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	3540.029	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-386.7086	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	148.7898	-
18	S _{12C}	Shear strength	MPa	145.3824	-
19	k	Thermal conductivity	W/m·K	353.236	-
20	C _p	Specific heat	kJ/kg·K	547.41	-

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Material properties

Weave

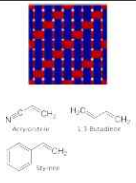
Brand	SK Chemical
Pattern	Woven
Fiber material	Carbon
Lay up type	Multi layer

Resin

Type	PE
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Material properties

Property	Unit	Value
E-Modulus	GPa	111
Poisson's ratio	-	0.27
Density	g/mm ³	1.76



Property according to direction(XYZ)

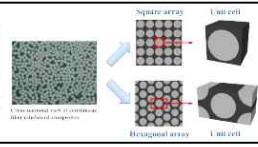
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.744E-09	-
2	E ₁	Young's Modulus X	MPa	122545.5	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9168.376	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	9622.256	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.432465	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.5228895	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.314418	-
8	G ₁₂	Shear Modulus XY	MPa	4691.376	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4039.796	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	5262.401	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	3571.326	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4796.781	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	4030.484	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-3104.562	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	288.6698	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-302.2863	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	122.6664	-
18	S _{12C}	Shear strength	MPa	147.654	-
19	k	Thermal conductivity	W/m·K	482.303	-
20	C _p	Specific heat	kJ/kg·K	431.76	-

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Material properties

Weave

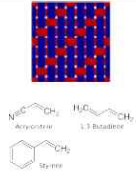
Brand	SK Chemical
Pattern	Woven
Fiber material	Carbon
Lay up type	Multi layer

Resin

Type	PE
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Material properties

Property	Unit	Value
E-Modulus	GPa	104
Poisson's ratio	-	0.27
Density	g/mm ³	1.74



Property according to direction(XYZ)

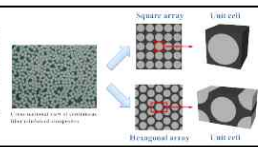
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.916E-09	-
2	E ₁	Young's Modulus X	MPa	166895.3	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9894.584	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	10076.136	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.4128075	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.5071635	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.24186	-
8	G ₁₂	Shear Modulus XY	MPa	4626.218	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3323.058	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4505.221	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	4096.521	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3641.352	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3812.62	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-299.563	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	294.1164	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-296.8397	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	163.5552	-
18	S _{12C}	Shear strength	MPa	123.8022	-
19	k	Thermal conductivity	W/m·K	373.615	-
20	C _p	Specific heat	kJ/kg·K	562.83	-

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Material properties

Weave

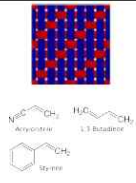
Brand	SK Chemical
Pattern	Woven
Fiber material	Carbon
Lay up type	Multi layer

Resin

Type	PE
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Material properties

Property	Unit	Value
E-Modulus	GPa	116
Poisson's ratio	-	0.25
Density	g/mm ³	1.71



Property according to direction(XYZ)

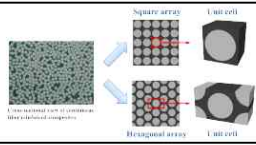
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.444E-09	-
2	E ₁	Young's Modulus X	MPa	162226.9	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9803.808	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	10620.792	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.5071635	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.5307525	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.2515344	-
8	G ₁₂	Shear Modulus XY	MPa	4007.217	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4854.271	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	5489.555	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	525.195	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4761.768	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3104.562	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-340.4125	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	381.262	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-345.8591	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	138.5676	-
18	S _{12C}	Shear strength	MPa	138.5676	-
19	k	Thermal conductivity	W/m·K	475.51	-
20	C _p	Specific heat	kJ/kg·K	385.5	-

DYETEC 다이텍연구원

Data base report of material properties library for polymer composite engineering

Theory

Representative elementary volume (REV) is the smallest volume over which a measurement can be made that will yield a value representative of the whole. In the case of periodic materials, one simply chooses a periodic unit cell (which, however, may be non-unique), but in random media, the situation is much more complicated.



Material properties

Weave

Brand	SK Chemical
Pattern	Woven
Fiber material	Carbon
Lay up type	Multi layer

Material properties

Property	Unit	Value
E-Modulus	GPa	116
Poisson's ratio	-	0.27
Density	g/mm ³	1.66

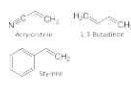


Resin

Type	PE
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Material properties

Property	Unit	Value
E-Modulus	MPa	450
Poisson's ratio	-	0.3
Density	g/mm ³	1.58



Property according to direction(XYZ)

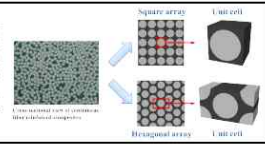
No.	Symbol	Properties	Unit	Value	Notes
1	ρ	Density	g/mm ³	1.916E-09	-
2	E_1	Young's Modulus X	MPa	119044.2	Longitudinal modulus
3	E_2	Young's Modulus Y	MPa	12436.312	Transverse Modulus
4	E_3	Young's Modulus Z	MPa	9985.36	-
5	ν_{12}	Poisson's ratio XY	MPa	0.518958	-
6	ν_{13}	Poisson's ratio YZ	MPa	0.573999	-
7	ν_{23}	Poisson's ratio XZ	MPa	0.338604	-
8	G_{12}	Shear Modulus XY	MPa	4267.849	In-plane shear modulus
9	G_{13}	Shear Modulus YZ	MPa	4300.428	Out-of-plane shear modulus
10	G_{23}	Shear Modulus XZ	MPa	4959.529	Out-of-plane shear modulus
11	S_{11T}	Longitudinal Tensile strength	MPa	4551.69	Strain: 0.03%
12	S_{11C}	Longitudinal Compressive strength	MPa	-3851.43	Strain: 0.03%
13	S_{22T}	Transverse Tensile strength	MPa	3567.523	Strain: 0.03%
14	S_{22C}	Transverse compressive strength	MPa	-373.0921	Strain: 0.03%
15	S_{33T}	Tensile strength	MPa	345.8591	Strain: 0.03%
16	S_{33C}	Compressive strength	MPa	-354.029	Strain: 0.03%
17	S_{23T}	Out-of-plane shear strength	MPa	126.0738	-
18	S_{31T}	Shear strength	MPa	163.5552	-
19	k	Thermal conductivity	W/m.K	407.58	-
20	C_p	Specific heat	kJ/kg.K	485.73	-

DYETEC 다이텍연구원

Data base report of material properties library for polymer composite engineering

Theory

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Material properties

Weave

Brand	SK Chemical
Pattern	Woven
Fiber material	Carbon
Lay up type	Multi layer

Material properties

Property	Unit	Value
E-Modulus	GPa	114
Poisson's ratio	-	0.29
Density	g/mm ³	1.84

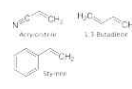


Resin

Type	PE
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Material properties

Property	Unit	Value
E-Modulus	MPa	427
Poisson's ratio	-	0.26
Density	g/mm ³	1.67



Property according to direction(XYZ)

No.	Symbol	Properties	Unit	Value	Notes
1	ρ	Density	g/mm ³	1.630E-09	-
2	E_1	Young's Modulus X	MPa	137717.8	Longitudinal modulus
3	E_2	Young's Modulus Y	MPa	12254.76	Transverse Modulus
4	E_3	Young's Modulus Z	MPa	10166.912	-
5	ν_{12}	Poisson's ratio XY	MPa	0.4363965	-
6	ν_{13}	Poisson's ratio YZ	MPa	0.5150265	-
7	ν_{23}	Poisson's ratio XZ	MPa	0.2805576	-
8	G_{12}	Shear Modulus XY	MPa	3453.374	In-plane shear modulus
9	G_{13}	Shear Modulus YZ	MPa	3876.901	Out-of-plane shear modulus
10	G_{23}	Shear Modulus XZ	MPa	5186.683	Out-of-plane shear modulus
11	S_{11T}	Longitudinal Tensile strength	MPa	3746.391	Strain: 0.03%
12	S_{11C}	Longitudinal Compressive strength	MPa	-4656.729	Strain: 0.03%
13	S_{22T}	Transverse Tensile strength	MPa	4084.95	Strain: 0.03%
14	S_{22C}	Transverse compressive strength	MPa	-324.0727	Strain: 0.03%
15	S_{33T}	Tensile strength	MPa	405.7717	Strain: 0.03%
16	S_{33C}	Compressive strength	MPa	-291.3933	Strain: 0.03%
17	S_{23T}	Out-of-plane shear strength	MPa	124.938	-
18	S_{31T}	Shear strength	MPa	165.8268	-
19	k	Thermal conductivity	W/m.K	482.303	-
20	C_p	Specific heat	kJ/kg.K	385.5	-