

복합재료(Composite+ABS) 물성 DB (200개)

○ 시험 개요

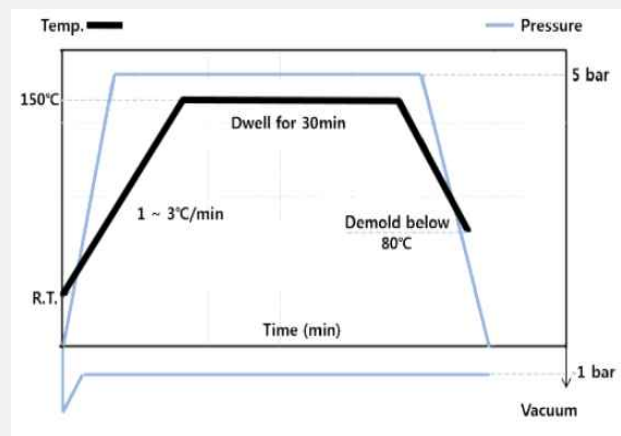
탄소섬유 강화 복합재료에 대한 시뮬레이션 물성 라이브러리를 구축하기 위해, 다양한 복합구조체의 섬유 방향과 적층수와 수지 종류에 따른 재료 물성 차이를 조사하고, 이에 따른 결과를 데이터 베이스(Data Base, DB) 구축하는 것이 목적임.

○ 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)

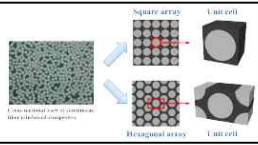


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Theory

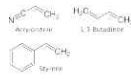
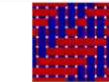
Representative elementary volume (REV) is the smallest volume over which a measurement can be made that will yield a value representative of the whole. In the case of periodic materials, one simply chooses a periodic unit cell (which, however, may be non-unique), but in random media, the situation is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



Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 126
Fiber material	Carbon	Poisson's ratio	- 0.25
Lay up type	Multi layer	Density	g/mm ³ 1.72

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 565
		Poisson's ratio	- 0.29
		Density	g/mm ³ 1.59



Property according to direction(XYZ)

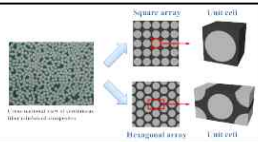
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.716E-09	-
2	E ₁	Young's Modulus X	MPa	15892.7	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	12254.76	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	12073.208	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.5464785	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.401013	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.3095808	-
8	G ₁₂	Shear Modulus XY	MPa	3453.374	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3551.111	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4467.362	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	3501.3	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3711.378	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3295.193	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-480.3251	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	403.0484	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-321.3494	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	157.8762	-
18	S _{12C}	Shear strength	MPa	144.2466	-
19	k	Thermal conductivity	W/m·K	400.787	-
20	C _p	Specific heat	kJ/kg·K	451.035	-

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Theory

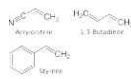
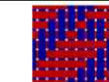
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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 101
Fiber material	Carbon	Poisson's ratio	- 0.28
Lay up type	Multi layer	Density	g/mm ³ 1.85

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 598
		Poisson's ratio	- 0.25
		Density	g/mm ³ 1.7



Property according to direction(XYZ)

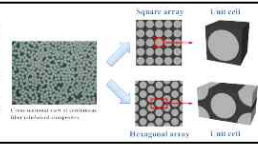
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	2.044E-09	-
2	E ₁	Young's Modulus X	MPa	130715.2	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	13616.4	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	9349.928	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.5867935	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.5150265	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.2805576	-
8	G ₁₂	Shear Modulus XY	MPa	4133.007	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3518.532	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	5451.696	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	3641.352	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3571.326	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	2777.766	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-351.3057	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	389.4319	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-343.1358	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	156.7404	-
18	S _{12C}	Shear strength	MPa	126.0738	-
19	k	Thermal conductivity	W/m·K	472.1135	-
20	C _p	Specific heat	kJ/kg·K	454.89	-

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Theory

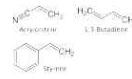
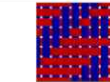
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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 130
Fiber material	Carbon	Poisson's ratio	- 0.26
Lay up type	Multi layer	Density	g/mm ³ 1.71

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 454
		Poisson's ratio	- 0.27
		Density	g/mm ³ 1.67



Property according to direction(XYZ)

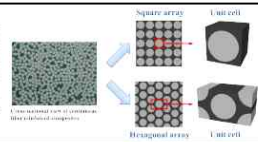
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	2.073E-09	-
2	E ₁	Young's Modulus X	MPa	152890.1	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	11347	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	11347	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.542547	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.416739	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.3458598	-
8	G ₁₂	Shear Modulus XY	MPa	3290.479	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3714.006	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4921.67	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	5251.95	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-5251.95	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3458.591	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-370.3688	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	392.1552	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-362.1989	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	123.8022	-
18	S _{12C}	Shear strength	MPa	170.37	-
19	k	Thermal conductivity	W/m·K	393.994	-
20	C _p	Specific heat	kJ/kg·K	462.6	-

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Theory

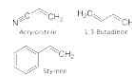
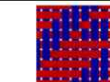
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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 100
Fiber material	Carbon	Poisson's ratio	- 0.3
Lay up type	Multi layer	Density	g/mm ³ 1.68

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 507
		Poisson's ratio	- 0.3
		Density	g/mm ³ 1.57



Property according to direction(XYZ)

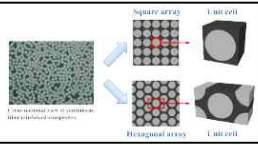
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.973E-09	-
2	E ₁	Young's Modulus X	MPa	124879.7	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	13162.52	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	12617.864	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.581862	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.495369	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.36279	-
8	G ₁₂	Shear Modulus XY	MPa	3746.585	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4104.954	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	3899.477	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	5006.859	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4341.612	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3295.193	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-315.9028	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	294.1164	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-275.0533	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	160.1478	-
18	S _{12C}	Shear strength	MPa	135.1602	-
19	k	Thermal conductivity	W/m·K	448.338	-
20	C _p	Specific heat	kJ/kg·K	400.92	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 127
Fiber material	Carbon	Poisson's ratio	- 0.3
Lay up type	Multi layer	Density	g/mm ³ 1.72

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 331
		Poisson's ratio	- 0.29
		Density	g/mm ³ 1.68

Property according to direction(XYZ)

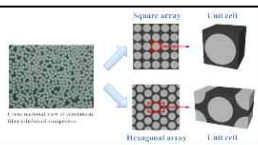
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	2.044E-09	-
2	E ₁	Young's Modulus X	MPa	163394	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9713.032	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	11891.656	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.5700675	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.416739	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.3192552	-
8	G ₁₂	Shear Modulus XY	MPa	4333.007	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4593.639	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	5338.119	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	4411.638	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3816.417	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	4057.717	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-334.9659	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	370.3688	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-302.2863	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	136.296	-
18	S _{12C}	Shear strength	MPa	130.617	-
19	k	Thermal conductivity	W/m·K	509.475	-
20	C _p	Specific heat	kJ/kg·K	443.325	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 113
Fiber material	Carbon	Poisson's ratio	- 0.26
Lay up type	Multi layer	Density	g/mm ³ 1.62

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 515
		Poisson's ratio	- 0.25
		Density	g/mm ³ 1.71

Property according to direction(XYZ)

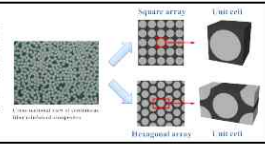
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.816E-09	-
2	E ₁	Young's Modulus X	MPa	137717.8	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9349.928	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	12436.312	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.511995	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.47178	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.2466972	-
8	G ₁₂	Shear Modulus XY	MPa	4461.323	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4267.849	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4997.388	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	4656.729	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-4201.56	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	3758.154	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-337.6892	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	397.6018	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-307.7329	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	134.0244	-
18	S _{12C}	Shear strength	MPa	136.296	-
19	k	Thermal conductivity	W/m·K	397.3905	-
20	C _p	Specific heat	kJ/kg·K	535.845	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 127
Fiber material	Carbon	Poisson's ratio	- 0.3
Lay up type	Multi layer	Density	g/mm ³ 1.72

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 331
		Poisson's ratio	- 0.29
		Density	g/mm ³ 1.68

Property according to direction(XYZ)

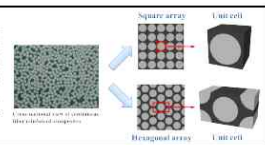
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	2.044E-09	-
2	E ₁	Young's Modulus X	MPa	163394	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9713.032	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	11891.656	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.5700675	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.416739	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.3192552	-
8	G ₁₂	Shear Modulus XY	MPa	4333.007	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	4593.639	Out-of-plane shear modulus
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17	S _{12T}	Out-of-plane shear strength	MPa	136.296	-
18	S _{12C}	Shear strength	MPa	130.617	-
19	k	Thermal conductivity	W/m·K	509.475	-
20	C _p	Specific heat	kJ/kg·K	443.325	-

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Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 130
Fiber material	Carbon	Poisson's ratio	- 0.3
Lay up type	Multi layer	Density	g/mm ³ 1.75

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	GPa 467
		Poisson's ratio	- 0.25
		Density	g/mm ³ 1.52

Property according to direction(XYZ)

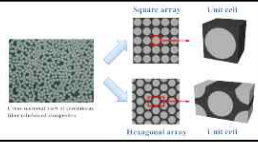
No.	Symbol	Properties	Unit	Value	Notes
1	p	Density	g/mm ³	1.844E-09	-
2	E ₁	Young's Modulus X	MPa	171563.7	Longitudinal modulus
3	E ₂	Young's Modulus Y	MPa	9803.808	Transverse Modulus
4	E ₃	Young's Modulus Z	MPa	10257.688	-
5	ν ₁₂	Poisson's ratio XY	MPa	0.589725	-
6	ν ₁₃	Poisson's ratio YZ	MPa	0.573999	-
7	ν ₂₃	Poisson's ratio XZ	MPa	0.350697	-
8	G ₁₂	Shear Modulus XY	MPa	3648.848	In-plane shear modulus
9	G ₁₃	Shear Modulus YZ	MPa	3355.637	Out-of-plane shear modulus
10	G ₂₃	Shear Modulus XZ	MPa	4921.67	Out-of-plane shear modulus
11	S _{11T}	Longitudinal Tensile strength	MPa	5111.898	Strain: 0.03%
12	S _{11C}	Longitudinal Compressive strength	MPa	-3711.378	Strain: 0.03%
13	S _{22T}	Transverse Tensile strength	MPa	2913.931	Strain: 0.03%
14	S _{22C}	Transverse compressive strength	MPa	-324.0727	Strain: 0.03%
15	S _{33T}	Tensile strength	MPa	334.9659	Strain: 0.03%
16	S _{33C}	Compressive strength	MPa	-343.1358	Strain: 0.03%
17	S _{12T}	Out-of-plane shear strength	MPa	138.5676	-
18	S _{12C}	Shear strength	MPa	126.0738	-
19	k	Thermal conductivity	W/m·K	339.65	-
20	C _p	Specific heat	kJ/kg·K	497.295	-

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Theory

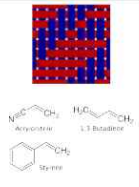
Representative elementary volume (REV) is the smallest volume over which a measurement can be made that will yield a value representative of the whole. In the case of periodic materials, one simply chooses a periodic unit cell (which, however, may be non-unique), but in random media, the situation is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



Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 128
Fiber material	Carbon	Poisson's ratio	- 0.29
Lay up type	Multi layer	Density	g/mm ³ 1.82

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	MPa 445
		Poisson's ratio	- 0.3
		Density	g/mm ³ 1.54



Property according to direction(XYZ)

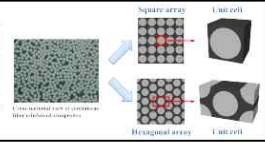
No.	Symbol	Properties	Unit	Value	Notes
1	ρ	Density	g/mm ³	2.002E-09	-
2	E_1	Young's Modulus X	MPa	140052	Longitudinal modulus
3	E_2	Young's Modulus Y	MPa	11347	Transverse Modulus
4	E_3	Young's Modulus Z	MPa	9168.376	-
5	ν_{12}	Poisson's ratio XY	MPa	0.416739	-
6	ν_{13}	Poisson's ratio YZ	MPa	0.534684	-
7	ν_{23}	Poisson's ratio XZ	MPa	0.2926506	-
8	G_{12}	Shear Modulus XY	MPa	3290.479	In-plane shear modulus
9	G_{13}	Shear Modulus YZ	MPa	3485.953	Out-of-plane shear modulus
10	G_{23}	Shear Modulus XZ	MPa	4618.798	Out-of-plane shear modulus
11	S_{11T}	Longitudinal Tensile strength	MPa	4201.56	Strain: 0.03%
12	S_{11C}	Longitudinal Compressive strength	MPa	-4061.508	Strain: 0.03%
13	S_{22T}	Transverse Tensile strength	MPa	2750.533	Strain: 0.03%
14	S_{22C}	Transverse compressive strength	MPa	-305.0096	Strain: 0.03%
15	S_{33T}	Tensile strength	MPa	334.9659	Strain: 0.03%
16	S_{33C}	Compressive strength	MPa	-305.0096	Strain: 0.03%
17	S_{12}	Out-of-plane shear strength	MPa	113.58	-
18	S_{13}	Shear strength	MPa	170.37	-
19	k	Thermal conductivity	W/m.K	489.096	-
20	C_p	Specific heat	kJ/kg.K	547.41	-

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Theory

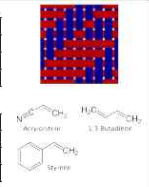
Representative elementary volume (REV) is the smallest volume over which a measurement can be made that will yield a value representative of the whole. In the case of periodic materials, one simply chooses a periodic unit cell (which, however, may be non-unique), but in random media, the situation is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



Material properties

Weave		Material properties	
Brand	SK Chemical	Property	Unit Value
Pattern	Woven	E-Modulus	GPa 104
Fiber material	Carbon	Poisson's ratio	- 0.3
Lay up type	Multi layer	Density	g/mm ³ 1.72

Resin		Material properties	
Type	ABS	Property	Unit Value
		E-Modulus	GPa 413
		Poisson's ratio	- 0.3
		Density	g/mm ³ 1.57



Property according to direction(XYZ)

No.	Symbol	Properties	Unit	Value	Notes
1	ρ	Density	g/mm ³	2.116E-09	-
2	E_1	Young's Modulus X	MPa	122545.5	Longitudinal modulus
3	E_2	Young's Modulus Y	MPa	12436.312	Transverse Modulus
4	E_3	Young's Modulus Z	MPa	12073.208	-
5	ν_{12}	Poisson's ratio XY	MPa	0.5307525	-
6	ν_{13}	Poisson's ratio YZ	MPa	0.4285335	-
7	ν_{23}	Poisson's ratio XZ	MPa	0.3361854	-
8	G_{12}	Shear Modulus XY	MPa	4202.691	In-plane shear modulus
9	G_{13}	Shear Modulus YZ	MPa	3779.164	Out-of-plane shear modulus
10	G_{23}	Shear Modulus XZ	MPa	4429.503	Out-of-plane shear modulus
11	S_{11T}	Longitudinal Tensile strength	MPa	3641.352	Strain: 0.03%
12	S_{11C}	Longitudinal Compressive strength	MPa	-3676.365	Strain: 0.03%
13	S_{22T}	Transverse Tensile strength	MPa	2913.931	Strain: 0.03%
14	S_{22C}	Transverse compressive strength	MPa	-329.5193	Strain: 0.03%
15	S_{33T}	Tensile strength	MPa	329.5193	Strain: 0.03%
16	S_{33C}	Compressive strength	MPa	-329.5193	Strain: 0.03%
17	S_{12}	Out-of-plane shear strength	MPa	140.8392	-
18	S_{13}	Shear strength	MPa	141.975	-
19	k	Thermal conductivity	W/m.K	423.166	-
20	C_p	Specific heat	kJ/kg.K	443.325	-