

APPENDICES

Table A1: Experimental design matrix

		Factor 1	Factor 2	Factor 3
Std	Run	A:Post-cure time (min)	B:Layer cure time (s)	C:Layer height (µm)
12	1	10	5	75
15	2	10	4	75
5	3	0	3	100
1	4	0	3	50
9	5	0	4	75
10	6	20	4	75
11	7	10	3	75
16	8	10	4	75
8	9	20	5	100
4	10	20	5	50
19	11	10	4	75
13	12	10	4	50
18	13	10	4	75
2	14	20	3	50
3	15	0	5	50
14	16	10	4	100
17	17	10	4	75
6	18	20	3	100
7	19	0	5	100

Table A2: ANOVA results for tensile modulus in the horizontal printing direction

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	9298000	8	1162000	190.85	< 0.0001
A-Post-cure time	6892000	1	6892000	1131.75	< 0.0001
B-Layer cure time	192700	1	192700	31.63	0.0002
C-Layer height	178800	1	178800	29.35	0.0003
AB	41761	1	41761	6.86	0.0257
BC	95048	1	95048	15.61	0.0027
A ²	483600	1	483600	79.41	< 0.0001
B ²	73232	1	73232	12.03	0.006
C ²	56040	1	56040	9.2	0.0126
Residual	60900	10	6090		
Lack of Fit	38934	6	6489	1.18	0.456
Pure Error	21966	4	5492		
Cor Total	9359000	18			

Table A3. ANOVA results for tensile modulus in the vertical printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	9936000	6	1656000	97.38	< 0.0001
A-Post-cure time	6986000	1	6986000	410.8	< 0.0001
B-Layer cure time	155000	1	155000	9.12	0.0107
C-Layer height	114500	1	114500	6.73	0.0235
BC	132100	1	132100	7.77	0.0164
A ²	1001000	1	1001000	58.86	< 0.0001
C ²	191300	1	191300	11.25	0.0057
Residual	204100	12	17005		
Lack of Fit	135400	8	16927	0.9863	0.5451
Pure Error	68645	4	17161		
Cor Total	10140000	18			

Table A4. ANOVA results for modulus anisotropy ratio.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	0.0182	4	0.0046	4.79	0.0121
A-Post-cure time	0.00000357	1	0.00000357	0.0038	0.952
C-Layer height	0.005	1	0.005	5.27	0.0376
AC	0.0063	1	0.0063	6.65	0.0219
A ²	0.0069	1	0.0069	7.23	0.0176
Residual	0.0133	14	0.001		
Lack of Fit	0.0106	10	0.0011	1.54	0.3611
Pure Error	0.0028	4	0.0007		
Cor Total	0.0315	18			

Table A5. ANOVA results for tensile strength in the horizontal printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	5787.64	2	2893.82	388.14	< 0.0001
A-Post-cure time	4582.6	1	4582.6	614.65	< 0.0001
A ²	1205.05	1	1205.05	161.63	< 0.0001
Residual	119.29	16	7.46		
Lack of Fit	106.62	12	8.88	2.8	0.1653
Pure Error	12.67	4	3.17		
Cor Total	5906.93	18			

Table A6. ANOVA results for tensile strength in the vertical printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	4084.47	6	680.74	181.85	< 0.0001
A-Post-cure time	2674.21	1	2674.21	714.36	< 0.0001
B-Layer cure time	46.7	1	46.7	12.47	0.0041
C-Layer height	42.23	1	42.23	11.28	0.0057
AB	23.19	1	23.19	6.19	0.0285
BC	12.55	1	12.55	3.35	0.092
A ²	1285.6	1	1285.6	343.42	< 0.0001
Residual	44.92	12	3.74		
Lack of Fit	36.33	8	4.54	2.11	0.245
Pure Error	8.59	4	2.15		
Cor Total	4129.39	18			

Table A7. ANOVA results for tensile strength anisotropy ratio.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	0.0886	1	0.0886	19.41	0.0004
A-Post-cure time	0.0886	1	0.0886	19.41	0.0004
Residual	0.0776	17	0.0046		
Lack of Fit	0.0618	13	0.0048	1.21	0.4702
Pure Error	0.0158	4	0.0039		
Cor Total	0.1663	18			

Table A8. ANOVA results for tensile strain in the horizontal printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	0.0933	3	0.0311	80.29	< 0.0001
A-Post-cure time	0.0533	1	0.0533	137.6	< 0.0001
C-Layer height	0.004	1	0.004	10.21	0.006
A ²	0.0361	1	0.0361	93.06	< 0.0001
Residual	0.0058	15	0.0004		
Lack of Fit	0.0052	11	0.0005	3.37	0.1261
Pure Error	0.0006	4	0.0001		
Cor Total	0.0991	18			

Table A9. ANOVA results for tensile strain in the vertical printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	258.95	6	43.16	42.89	< 0.0001
A-Post-cure time	148.3	1	148.3	147.36	< 0.0001
B-Layer cure time	1.17	1	1.17	1.16	0.3022
C-Layer height	18.28	1	18.28	18.16	0.0011
AC	12.2	1	12.2	12.12	0.0045
A ²	70.47	1	70.47	70.03	< 0.0001
B ²	6.09	1	6.09	6.05	0.03
Source	Sum of Squares	df	Mean Square	F-value	p-value
Residual	12.08	12	1.01		
Lack of Fit	12.06	8	1.51	301.41	< 0.0001
Pure Error	0.02	4	0.005		
Cor Total	271.03	18			

Table A10. ANOVA results for tensile strain anisotropy ratio.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	1.33	5	0.2653	3.84	0.0233
A-Post-cure time	0.5535	1	0.5535	8.02	0.0141
B-Layer cure time	0.0136	1	0.0136	0.1974	0.6641
C-Layer height	0.005	1	0.005	0.0729	0.7914
BC	0.3125	1	0.3125	4.53	0.053
B ²	0.4419	1	0.4419	6.4	0.0251
Residual	0.8972	13	0.069		
Lack of Fit	0.8904	9	0.0989	58.51	0.0007
Pure Error	0.0068	4	0.0017		
Cor Total	2.22	18			

Table A11. ANOVA results for flexural modulus in the horizontal printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	11940000	6	1989000	285.98	< 0.0001
A-Post-cure time	8445000	1	8445000	1213.98	< 0.0001
B-Layer cure time	371400	1	371400	53.39	< 0.0001
C-Layer height	146200	1	146200	21.01	0.0006
AB	202500	1	202500	29.11	0.0002
AC	228300	1	228300	32.82	< 0.0001
A ²	2543000	1	2543000	365.53	< 0.0001
Residual	83476	12	6956		
Lack of Fit	61641	8	7705	1.41	0.3916
Pure Error	21835	4	5459		
Cor Total	12020000	18			

Table A12. ANOVA results for flexural modulus in the vertical printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	9733000	6	1622000	195.23	< 0.0001
A-Post-cure time	6586000	1	6586000	792.65	< 0.0001
B-Layer cure time	375300	1	375300	45.16	< 0.0001
C-Layer height	79875	1	79875	9.61	0.0092
AB	33116	1	33116	3.99	0.0691
AC	57965	1	57965	6.98	0.0215
A ²	2601000	1	2601000	312.96	< 0.0001
Residual	99712	12	8309		
Lack of Fit	88172	8	11022	3.82	0.1055
Pure Error	11540	4	2885		
Cor Total	9833000	18			

Table A13. ANOVA results for flexural modulus anisotropy ratio.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	0.2184	6	0.0364	17.91	< 0.0001
A-Post-cure time	0.0026	1	0.0026	1.30	0.2793
B-Layer cure time	0.0001	1	0.0001	0.0416	0.8422
C-Layer height	0.0103	1	0.0103	5.06	0.0459
AB	0.0651	1	0.0651	32.03	0.0001
AC	0.0804	1	0.0804	39.57	< 0.0001
BC	0.0388	1	0.0388	19.11	0.0011
Residual	0.0224	11	0.0020		
Lack of Fit	0.0171	7	0.0024	1.86	0.2871
Pure Error	0.0053	4	0.0013		
Cor Total	0.2407	17			

Table A14. ANOVA results for flexural strength in the horizontal printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	14257.38	6	2376.23	208.23	< 0.0001
A-Post-cure time	9014.41	1	9014.41	789.94	< 0.0001
B-Layer cure time	597.37	1	597.37	52.35	< 0.0001
C-Layer height	218.84	1	218.84	19.18	0.0009
AB	213.21	1	213.21	18.68	0.001
AC	255.83	1	255.83	22.42	0.0005
A ²	3957.72	1	3957.72	346.82	< 0.0001
Residual	136.94	12	11.41		
Lack of Fit	113.77	8	14.22	2.46	0.2011
Pure Error	23.17	4	5.79		
Cor Total	14394.32	18			

Table A15. ANOVA results for flexural strength in the vertical printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	11609.74	5	2321.95	236.36	< 0.0001
A-Post-cure time	6772.49	1	6772.49	689.39	< 0.0001
B-Layer cure time	587.06	1	587.06	59.76	< 0.0001
C-Layer height	55.04	1	55.04	5.6	0.0341
AB	119.74	1	119.74	12.19	0.004
A ²	4075.42	1	4075.42	414.85	< 0.0001
Residual	127.71	13	9.82		
Lack of Fit	92.74	9	10.3	1.18	0.471
Pure Error	34.97	4	8.74		
Cor Total	11737.45	18			

Table A16. ANOVA results for flexural strength anisotropy ratio.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	0.2434	5	0.0487	9.5	0.0005
A-Post-cure time	0.036	1	0.036	7.03	0.02
B-Layer cure time	0.0013	1	0.0013	0.2529	0.6235
C-Layer height	0.0717	1	0.0717	13.99	0.0025
AC	0.1181	1	0.1181	23.05	0.0003
BC	0.0164	1	0.0164	3.2	0.0971
Residual	0.0666	13	0.0051		
Lack of Fit	0.0644	9	0.0072	13.16	0.0122
Pure Error	0.0022	4	0.0005		
Cor Total	0.31	18			

Table A17. ANOVA results for flexural strain in the horizontal printing direction.

Source	Sum of squares	df	Mean square	F-value	p-value
Model	39.48	6	6.58	13.02	0.001
A-Post-cure time	4.36	1	4.36	8.63	0.0188
B-Layer cure time	2.33	1	2.33	4.61	0.0641
C-Layer height	0.0102	1	0.0102	0.0203	0.8903
AB	5.41	1	5.41	10.71	0.0113
AC	2.07	1	2.07	4.11	0.0773
BC	13.86	1	13.86	27.44	0.0008
Residual	4.04	8	0.5052		
Lack of fit	1.36	4	0.3391	0.5052	0.7377
Pure error	2.69	4	0.6713		
Cor total	43.52	14			

Table A18. ANOVA results for flexural strain in the vertical printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	17.48	7	2.50	34.52	0.0002
A-Post-cure time	0.0093	1	0.0093	0.1290	0.7317
B-Layer cure time	0.2774	1	0.2774	3.83	0.0979
C-Layer height	11.14	1	11.14	154.00	< 0.0001
AC	14.00	1	14.00	193.50	< 0.0001
BC	1.54	1	1.54	21.26	0.0037
B ²	0.7860	1	0.7860	10.87	0.0165
C ²	0.8305	1	0.8305	11.48	0.0147
Residual	0.4340	6	0.0723		
Lack of Fit	0.0133	2	0.0066	0.0632	0.9397
Pure Error	0.4207	4	0.1052		
Cor Total	17.91	13			

Table A19. ANOVA results for Charpy impact in the horizontal printing direction.

Source	Sum of Squares	df	Mean Square	F-value	p-value
Model	1.59E+07	3	5298000	9.7	0.0008
A-Post-cure time	1.42E+07	1	14240000	26.07	0.0001
B-Layer cure time	1.64E+06	1	1635000	2.99	0.1041
C-Layer height	17139.6	1	17140	0.0314	0.8618
Residual	8.19E+06	15	546300		
Lack of Fit	5.76E+06	11	524000	0.8626	0.6199
Pure Error	2.43E+06	4	607500		
Cor Total	2.41E+07	18	5298000		

Table A20. Model statistics

		Std. Dev.	Mean	R ²	Adj. R ²	Pred. R ²	Adeq. Prec.
Tensile modulus	Horizontal	130.4	2390.16	0.980	0.970	0.942	28.78
	Vertical	78.04	2330.68	0.994	0.988	0.974	45.08
	Anisotropy	0.0308	1.02	0.578	0.457	0.122	6.98
Tensile strength	Horizontal	2.73	58.3	0.980	0.977	0.972	39.46
	Vertical	1.93	56.04	0.989	0.984	0.961	36.38
	Anisotropy	0.2627	0.9871	26.62	0.5965	0.4414	-0.5231
Tensile strain	Horizontal	0.0197	0.1831	0.941	0.930	0.893	22.15
	Vertical	1	7.48	0.955	0.933	0.874	19.46
	Anisotropy	0.0577	1.05	0.705	0.646	0.501	10.70
Flexural modulus	Horizontal	83.4	2186.45	0.993	0.990	0.981	50.59
	Vertical	91.16	2009.85	0.990	0.985	0.971	39.57
	Anisotropy	0.0451	1.08	0.9072	0.8565	0.2625	19.2757
Flexural strength	Horizontal	3.38	79.26	0.991	0.986	0.973	43.84
	Vertical	3.13	75.08	0.989	0.985	0.976	43.66
	Anisotropy	0.0696	1.04	0.781	0.7184	0.3722	14.075
Flexural strain	Horizontal	0.7108	5.96	0.9071	0.8375	0.6528	11.4903
	Vertical	0.269	5.82	0.9758	0.9475	0.9408	23.2161
	Anisotropy	0.1718	1.03	0.794	0.725	0.610	11.19
Charpy impact	Hor.	739.11	4037.32	0.660	0.592	0.468	9.67
	Vertical	685.44	2895.21	0.343	0.261	-0.083	6.46
	Anisotropy	0.4753	1.47	0.188	0.140	-0.101	3.86

Table A21. Model coded equations

		Intercept	A	B	C	AB	AC	BC	A ²	B ²	C ²
Tensile modulus	Horizontal	2816.15	835.8	124.5	-107			128.5	-563.2		-246.2
	Vertical	2713.65	830.2	138.8	-133.7	-72.25		109	-420.71	-163.71	-143.21
	Anisotropy	1.04	-0.0006		0.0224		-0.0281		-0.0381		
Tensile strength	Horizontal	66.7	21.41						-15.95		
	Vertical	64.71	16.35	2.16	-2.06	-1.7		1.25	-16.47		
	Anisotropy	1.09	0.0947		0.0203						-0.0735
Tensile strain	Horizontal	0.229	0.073		0.0199				-0.0872		
	Vertical	5.73	-3.85	-0.342	-1.35		1.24		4.73	-1.39	
	Anisotropy	0.8263	-0.2348	0.0374	-0.0229			-0.1971		0.305	
Flexural modulus	Horizontal	2572.06	918.95	192.72	-120.9	-159.11	168.94		-732.67		
	Vertical	2399.83	811.57	193.72	-89.37	-64.34	85.12		-740.94		
	Anisotropy	1.08	0.0419	0.0264	-0.0605	-0.0802	0.0924	0.0555			
Flexural strength	Horizontal	94.47	30.02	7.73	-4.68	-5.16	5.66		-28.91		
	Vertical	90.52	26.02	7.66	-2.35	-3.87			-29.33		
	Anisotropy	1.04	0.06	0.0114	-0.0847		0.1215	0.0453			
Flexural strain	Horizontal	5.3	1.11	-0.8943	0.0593	1.65	-1.02	-1.82			
	Vertical	5.79	0.0816	-0.215	2.36		-3.24	0.62			
	Anisotropy	0.9525		-0.1223	-0.2747			-0.6394			
Charpy	Hor.	4037.32	-1193.4	-404.4	41.4						
	Vertical	2895.21	-387.8	-491.6							
	Anisotropy	1.47	-0.2977								

Note: A - layer cure time, B - layer height, C - post-curing time

Table A22. Model actual equations

		Intercept	A	B	C	AB	AC	BC	A ²	B ²	C ²
Tensile modulus	Horizontal	566.3831	196.2194	-261	34247.3239			5140	-5.6320		-393915
	Vertical	1580.6454	196.0623	1193.7407	11582.7217	-7.2250		4360	-4.2071	163.7113	-229138
	Anisotropy	0.8549	0.0160		2.0208		-0.1125		-0.0004		
Tensile strength	Horizontal	29.3420	5.3307						-0.1595		
	Vertical	37.6270	5.6112	0.1060	-282.60	-0.1703		50.1	-0.1647		
	Anisotropy	0.2701	0.0095		18.4537						-117.6081
Tensile strain	Horizontal	0.0091	0.0248		0.7957				-0.0009		
	Vertical	1.2059	-1.7008	10.7712	-103.480		4.9400		0.0473	-1.3892	
	Anisotropy	3.4952	-0.0235	-1.8113	30.6142			-7.8825		0.3050	
Flexural modulus	Horizontal	382.6373	251.389	351.8338	-11593.790	15.9109	675.7750		-7.3267		
	Vertical	338.5498	229.544	258.0618	-6979.770	-6.4339	340.4850		-7.4095		
	Anisotropy	1.7322	0.0086	-0.0598	-14.9865	-0.0080	0.3695	2.2182			
Flexural strength	Horizontal	14.9770	9.1520	12.8915	-413.320	-0.5163	22.6200		-0.2891		
	Vertical	-3.9210	10.0163	11.5308	-93.840	-0.3869			-0.2933		
	Anisotropy	2.0940	-0.0304	-0.1244	-15.4862		0.4859	1.8101			
Flexural strain	Horizontal	-10.7705	-0.2433	2.9260	335.3096	0.1654	-4.0965	72.9931			
	Vertical	-2.7871	0.9802	-2.0750	124.8000		-12.9600	24.8000			
	Anisotropy	-5.4076		1.7960	91.3238			25.5776			
Charpy	Hor.	6724.1158	-119.340	-404.40	1656						
	Vertical	5249.4105	-38.780	-491.60							
	Anisotropy	1.7628	-0.0298								

Note: A - layer cure time, B - layer height, C - post-curing time