Determining Process-Window for 3D Printing of Continuous Carbon Fiber Composites

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**Table S1.** Print parameters of printed composites to determine the process window.

|  |  |  |  |
| --- | --- | --- | --- |
| Sample name | ɸ (mm) | h (mm) | Vp (mm/min) |
| 1 | 1.5 | 0.9 | 60 |
| 2 | 1.5 | 0.5 | 60 |
| 3 | 1.5 | 0.9 | 120 |
| 4 | 1.5 | 1.1 | 60 |
| 5 | 1.5 | 1.1 | 120 |
| 6 | 1.5 | 0.2 | 60 |
| 7 | 1.5 | 0.8 | 180 |
| 8 | 1.5 | 0.9 | 180 |
| 9 | 1.5 | 1.1 | 180 |
| 10 | 1.7 | 1.5 | 120 |
| 11 | 1.5 | 0.8 | 120 |
| 12 | 1.7 | 0.8 | 180 |
| 13 | 1.7 | 0.5 | 60 |
| 14 | 1.7 | 0.8 | 120 |
| 15 | 1.7 | 1.1 | 60 |
| 16 | 1.7 | 1.1 | 60 |
| 17 | 1.7 | 0.8 | 60 |
| 18 | 1.5 | 0.8 | 60 |
| 19 | 1.7 | 1.1 | 120 |
| 20 | 1.5 | 0.5 | 120 |
| 21 | 1.5 | 0.1 | 60 |
| 22 | 1.5 | 0.2 | 120 |
| 23 | 1.7 | 0.2 | 60 |
| 24 | 1.7 | 0.5 | 180 |
| 25 | 1.5 | 0.5 | 180 |
| 26 | 1 | 0.2 | 60 |
| 27 | 1.5 | 0.5 | 120 |
| 28 | 1.5 | 0.5 | 120 |
| 29 | 1.5 | 0.5 | 180 |
| 30 | 1 | 0.5 | 60 |
| 31 | 1.7 | 1.4 | 120 |
| 32 | 1.5 | 1.4 | 60 |
| 33 | 1.5 | 1.8 | 60 |
| 34 | 1.5 | 1.8 | 120 |
| 35 | 1.5 | 1.5 | 120 |
| 36 | 1.5 | 1.4 | 180 |
| 37 | 1.5 | 1.5 | 60 |
| 38 | 1.7 | 1.4 | 60 |
| 39 | 1.5 | 1.4 | 120 |
| 40 | 1.5 | 1.5 | 180 |
| 41 | 1.7 | 1.7 | 60 |

**Table S2.** The calculated E values from mass balance equation in comparison to print path length (~100 mm) at different conditions.

|  |  |  |  |
| --- | --- | --- | --- |
| ɸ (mm) | h (mm) | Vp (mm/min) | E (mm) |
| 1.5 | 0.1 | 60-120-180 | ~9 |
| 1.5 | 0.2 | 60-120-180 | ~18 |
| 1.5 | 0.5 | 60-120-180 | ~45 |
| 1.5 | 0.8 | 60-120-180 | ~72 |
| 1.5 | 0.9 | 60-120-180 | ~81 |
| 1.5 | 1.1 | 60-120-180 | ~99 |
| 1.5 | 1.4 | 60-120-180 | ~127 |
| 1.5 | 1.5 | 60-120-180 | ~136 |
| 1.5 | 1.8 | 60-120-180 | ~163 |
| 1.7 | 0.2 | 60-120-180 | ~20 |
| 1.7 | 0.5 | 60-120-180 | ~51 |
| 1.7 | 0.8 | 60-120-180 | ~81 |
| 1.7 | 1.1 | 60-120-180 | ~112 |
| 1.7 | 1.4 | 60-120-180 | ~143 |
| 1.7 | 1.7 | 60-120-180 | ~173 |

**Table S3.** The dimension of continuous carbon fiber-reinforced composites and neat ABS samples for mechanical tests.

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample name** | **Tensile test** | **Flexral test** | **ILSS test** |
| Neat ABS |  175×19.5×1.38 mm3 |  85 × 12.35 × 1.2 mm3 | 26 × 4.16 × 9.12 mm3 |
| Continuous carbon fiber-reinforced ABS composite | 175 × 20 × 1.85 mm3 | 85 × 12.5 × 1.4 mm3 | 26 × 4.23 × 9.94 mm3 |