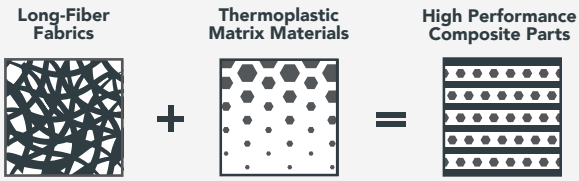
Impossible Objects®

# Composite 3D Printing
# Built for the Factory Floor


**CBAM TECHNOLOGY:**
Flexible. Powerful.
Rapid Production.




**COMPOSITE PARTS:**
Stronger. Lighter.
Tougher. Faster.

## Ground-Breaking Technology

Impossible Objects has developed an entirely new approach to 3D industrial printing called CBAM (Composite-Based Additive Manufacturing).

Our patented process leverages high-speed 2D graphics technologies and is specifically designed for volume production of high performance composite parts. Our system can produce complex geometries, multiple parts in one build block and runs at industrial speeds.

## More Advanced Materials

CBAM is the only AM technology to use long-fiber sheets of carbon or glass, bonded with thermoplastic matrix materials to make high-performance, reinforced composite parts. Our process yields parts with exceptional strength, temperature performance and chemical resistance.

We offer an unprecedented range of advanced materials—making our 3D composite technology one of the most flexible and customizable in the industry today.

## Available Material Combinations

**Carbon Fiber / PEEK** | **Carbon Fiber / Nylon 12** | **Glass Fiber / PEEK** | **Glass Fiber / Nylon 12**

### Materials in Development

Carbon Fiber / Nylon 6 • Carbon Fiber / Glass Fiber / Nylon 12 • Carbon Fiber / Elastomer • Glass Fiber / Elastomer

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| | | CARBON FIBER | |
|---|---|---|---|
| | | NYLON 12 | PEEK |
| **GENERAL PROPERTIES MEASUREMENT** | **TEST METHOD** | | |
| Density | | 1.10 g/cm³ (0.0397 lb/in³) | 1.40 g/cm³ (0.0506 lb/in³) |
| **MECHANICAL PROPERTIES MEASUREMENT** | **TEST METHOD** | **METRIC (U.S.)** | **METRIC (U.S.)** |
| Notched Impact Strength | ASTM D256 | 7.10 kJ/m² (3.38 ft-lb/in²) | 4.90 kJ/m² (2.33 ft-lb/in²) |
| Notched Impact Resistance (Complete Break) | ASTM D256 | 71.8 J/m (13.4 ft-lb/in) | 49.3 J/m (9.2 ft-lb/in) |
| Unnotched Impact Strength | ASTM D4812 | 20.9 kJ/m² (9.94 ft-lb/in²) | 13.2 kJ/m² (6.28 ft-lb/in²) |
| Unnotched Impact Resistance (Complete Break) | ASTM D4812 | 280 J/m (52.5 ft-lb/in) | 168 J/m (31.5 ft-lb/in) |
| Tensile Strength | ASTM D638 | 103 MPa - 150 MPa (14.9 kpsi - 21.7 kpsi) | 132 MPa - 200 MPa (19.1 kpsi - 29.0 kpsi) |
| Tensile Modulus | ASTM D638 | 9.38 GPa (1360 kpsi) | 12.74 GPa (1848 kpsi) |
| Poisson's ratio | ASTM D638 | 0.44 (0.44) | 0.32 (0.32) |
| Elongation % | ASTM D638 | 1.20% (1.20 %) | 1.04 % (1.04 %) |
| Compressive Strength | ASTM D695 | 53.8 MPa (7.80 kpsi) | 162.0 MPa (23.50 kpsi) |
| Ultimate Flexural Strength | ASTM D790 | 132 MPa (19.1 kpsi) | 176.7 MPa (25.6 kpsi) |
| Flex modulus | ASTM D790 | 9.05 GPa (1312 kpsi) | 12.4 GPa (1803 kpsi) |
| **THERMAL PROPERTIES MEASUREMENT** | **TEST METHOD** | **METRIC (U.S.)** | **METRIC (U.S.)** |
| Heat Deflection Temperature (HDT) | ASTM D648 | 167 °C (333 °F) | >300 °C (>572°F) |
| Thermal Resistivity | ASTM D5470 | 3.23 Km/W (5.58 (hr ft °F)/BTU) | 3.7 Km/W (6.41 (hr ft °F)/BTU) |
| Thermal conductivity | ASTM D5470 | 0.31 W/ m°K (0.18 BTU/(hr ft °F)) | 0.3 W/ m°K (0.16 BTU/(hr ft °F)) |
| Coefficient of Thermal Expansion (CTE) - below softening point (XY) | ASTM E831 | 24.5 µm/m°C (13.6 µin/(in-°F)) | 12.6 µm/m°C (7.0 µin/(in-°F)) |
| Coefficient of Thermal Expansion (CTE) - above softening point (XY) | ASTM E831 | 34.7 µm/m°C (19.3 µin/(in-°F)) | 10.4 µm/m°C (5.8 µin/(in-°F)) |
| Coefficient of Thermal Expansion (CTE) - below softening point (Z) | ASTM E831 | 177 µm/m°C (98.2 µin/(in-°F)) | 65.5 µm/m°C (36.4 µin/(in-°F)) |
| Coefficient of Thermal Expansion (CTE) - above softening point (Z) | ASTM E831 | 389 µm/m°C (216 µin/(in-°F)) | 247 µm/m°C (137 µin/(in-°F)) |

ASTM testing conducted at Composites Innovation Center in Winnipeg, Canada, except the testing for tensile strength and tensile modulus additionally conducted by Impossible Objects. Tensile strength and modulus, as well as other properties, can vary based on build process settings.

This representative data was tested, measured, or calculated using standard methods and is subject to change without notice. Impossible Objects makes no warranties of any kind, express or implied, including, but not limited to, the warranties of merchantability or fitness for a particular use, and assumes no liability in connection with the use of this information.The data listed here should not be used to establish design, quality control, or specification limits, and is not intended to substitute for your own testing to determine suitability for your particular application.

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# Carbon-Fiber Composite 3D Printing Built for the Factory Floor


**CBAM-2 Printer**

## Ground-Breaking Technology

Impossible Objects has developed an entirely new approach to 3D industrial printing called CBAM (Composite-Based Additive Manufacturing).

Our patented process leverages high-speed 2D graphics technologies and is specifically designed for volume production of high performance composite parts. Our system can produce complex geometries, multiple parts in one build block and runs at industrial speeds.

## The New CBAM-2 Printer

The CBAM-2 system is the only AM printer that uses long-fiber carbon and glass sheets bonded with high-performance thermoplastic materials to deliver parts that are stronger, lighter, with better temperature performance, and more durable than ever before.

We offer an unprecedented range of advanced materials—making our 3D composite technology one of the most flexible and customizable in the industry.

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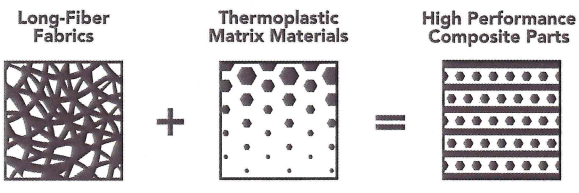


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## Printer Specifications

| | |
|---|---|
| **Technology** | CBAM, Composite-Based Additive Manufacturing |
| **Speed** | 45 $in^3$ per hour |
| **Max Build Volume** | 576 $in^3$ (12 in x 12 in x 4 in*) / 9,439 $cm^3$ (30.5 cm x 30.5 cm x 10.2 cm)<br>*Print height is not limited by the machine and taller heights may be possible for custom applications |
| **Print Resolution** | 600 dpi / 42 µm |
| **Accuracy** | For part dimensions under 5 in, .005 in (125 µm)<br>For part dimensions greater than 5 in, 0.1% of the part dimemsion |
| **Layer Height** | 0.002 in (50 µm) |
| **Substrate Materials** | Carbon Fiber: 12 in x 12 in (30.5 cm x 30.5 cm), 8 in x 12 in (20 cm x 30.5 cm)<br>Glass Fiber: 12 in x 12 in (30.5 cm x 30.5 cm), 8 in x 12 in (20 cm x 30.5 cm) |
| **Polymer Materials** | PEEK, PA12 |
| **Operating Environment** | Temperature: 59 °F (15 °C) to 86 °F (30 °C)<br>Humidity: 20 – 70% RH, non-condensing |
| **System Size / Weight** | 140 in L x 38.5 in D x 83.5 in H; 2,800 lbs / 356 cm L x 98 cm D x 212 cm H; 1,273 kg |

## Operating Services

| | |
|---|---|
| **Build Preparation Software** | Compatible with commercial slicing, Netfabb, and Materialize |
| **Printer Operating System** | Proprietary software compatible with Windows |
| **Connectivity** | Wi-fi and Ethernet |
| **Compressed Air** | 90 – 120 PSI, 40 CFM |
| **Power** | 240 or 208 VAC, Single Phase, 20 AMP Circuit |
| **Warranty** | One year |

* Specifications subject to change. May 2019.

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