3D Printing For Manufacturing

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Southeast Regional Sales Manager

ENVISIONTEC
Additive Manufacturing can add value to many traditional forms of manufacturing.
The Value Of Additive Manufacturing

- Reduce cost of error by locating them and fixing earlier in design cycle
- Compression of time by “insourcing “, creating models within hours
- Increasing the number of prototyping iterations during the early design stage
- Keep it Confidential
- Dependable and reliable made with industrial grade components
Direct Manufacturing

PRO HELMET DECALS

[Images of LA and a helmet with a V emblem]
Direct Manufacturing

A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. A jig is often confused with a fixture; a fixture holds the work in a fixed location. A device that does both functions (holding the work and guiding a tool) is called a jig.
Fixtures are used to securely locate (position in a specific location or orientation) and support the work, ensuring that all parts produced using the fixture will maintain conformity and interchangeability.
Fixtures
Injection Molding

Injection Molding Machine
Injection Molding
Injection Molding
Investment Casting
It is going well. So well in fact that we are considering the possibility of another printer in a few months. I have gotten most things figured out. I am still interested in training in Dearborn so if you could send some dates for May and June, I would appreciate it. Thanks for checking in.
Extrusion Dies

[Diagram of extrusion dies and associated equipment]

[Images of extrusion process and machinery]
Thermoforming/Pressure Forming
Thermoforming
Silicone Molds
Silicone Molds
## Metals Printing

### Manufacturer Series

<table>
<thead>
<tr>
<th></th>
<th>No. of Heads Included</th>
<th>Max Heads</th>
<th>Tool Changer Type</th>
<th>Head Temperature Range</th>
<th>Cartridge Sizes</th>
<th>Other Usable Modules</th>
<th>Platform Temp. Control</th>
<th>Platform Height Control</th>
<th>Needle Calibration</th>
<th>Material Calibration</th>
<th>Filters Included</th>
<th>External Temp. Ports</th>
<th>Included PC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter Series</strong></td>
<td>2 print heads included</td>
<td>2 print heads max</td>
<td>Fixed Side-by-Side Tools</td>
<td>30°C - 250°C</td>
<td>3ml - 30ml</td>
<td>none</td>
<td>No</td>
<td>Manual</td>
<td>Photo Sensor</td>
<td>Manual</td>
<td>Particle</td>
<td>0</td>
<td>Built-In PC</td>
</tr>
<tr>
<td><strong>Developer Series V3</strong></td>
<td>2 print heads included</td>
<td>3 print heads max</td>
<td>Modular Tool Changer</td>
<td>0°C - 70°C</td>
<td>10ml - 30ml</td>
<td>All</td>
<td>Yes</td>
<td>Automatic</td>
<td>Photo Sensor</td>
<td>Manual</td>
<td>Sterile &amp; Particle</td>
<td>0</td>
<td>Professional PC</td>
</tr>
<tr>
<td><strong>Manufacturer Series</strong></td>
<td>2 print heads included</td>
<td>5 print heads max</td>
<td>Modular Tool Changer</td>
<td>0°C - 70°C</td>
<td>10ml - 30ml</td>
<td>All</td>
<td>Yes</td>
<td>Automatic</td>
<td>Camera</td>
<td>Semi-Automatic</td>
<td>Sterile &amp; Particle</td>
<td>4</td>
<td>Professional PC</td>
</tr>
</tbody>
</table>
• Uses raw materials (powder, pellets, etc.) without requiring a preprocessed filament.

• Medical-grade materials can be used.

• Materials are kept in sterilizable cartridges, thus avoiding touching the machine: easier to clean and sterilize.

• Each customer can create their own processing parameters.

• Not locked to any proprietary materials, customers can choose their preferred vendors, as well as required medical grades, mixture compositions and concentrations, additives, etc.
Metals Printing

Finished Product
Mix powdered metal with viscous binder

Load into Bio Plotter low temp head and print

Place printer part into sintering oven

Methylcellulose Polyvinyl Alcohol
Sand Casting

For a sand casting

Cope
Drag
Mold cavity
Core
Sand Casting

Over 70% of all metal castings are produced via sand casting.
Sand Casting – Viridis3D

RAM123 Advantages:
- Continuous Production
- Simple to Use Software
- Robust ABB Robotics
- Heavy Duty Palmer Auxiliaries
- Short Set-up Time
- Optimized Materials Consumption
- Lower Installation Cost
- Lower Operating Cost
- Standard Foundry Sands and Resins

RAM123 Base System Includes:
- 28" Wide Printhead,
- ABB® Robotics & Controls
- Palmer® P-12 Powder Feeder
- Palmer 4000lb Hopper
- Uses Pre-blended Materials
- ViriPrint™ Desktop Software
- 1 year System Warranty
- Dry Catalyst Furan™ Materials

envisionTEC
EnvisionTEC Reveals SLCOM 1 as their Biggest 3D Printing Innovation of 2016 at RAPID

EnvisionTEC to introduce the first industrial scale 3D printer for the production of woven fiber composite parts
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### Machine Properties

<table>
<thead>
<tr>
<th>Machine Properties</th>
<th>SLCOM1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build Envelope</td>
<td>30” x 24” x 24”</td>
</tr>
<tr>
<td>Accuracy</td>
<td>+/- 100 microns in X and Y</td>
</tr>
<tr>
<td></td>
<td>One layer thickness in Z after lamination</td>
</tr>
<tr>
<td>Cutting Speed</td>
<td>Up to 20 inches per second linear speed</td>
</tr>
<tr>
<td>Min/Max Layer Thickness</td>
<td>0.1 mm to 1.0 mm (prior to lamination)</td>
</tr>
<tr>
<td>Build Speed</td>
<td>Post lamination layer thickness dependent</td>
</tr>
<tr>
<td>Material</td>
<td>UNI and Bidirectional Thermoplastic Pre-pregs</td>
</tr>
<tr>
<td>Cutting Gantry</td>
<td>4 Full AXiS cutting Gantry system (XYZR)</td>
</tr>
<tr>
<td>Footprint</td>
<td>125”H x 156” W x 93” D</td>
</tr>
</tbody>
</table>

### System Properties

- Builds solid parts using layer-by-layer laminated thermoplastic composite fabric sheets from a roll
- Unique material storage feed concept
- 48” x 48” X/Y/Z cutter range with 30kHz ultrasonic blade cutter
- Automatic blade replacement with blade wearing auto detection
- Automatic anti-lamination fluid application
- Waste material not fully laminated to build, reducing post-processing
- Processes continuous fiber-reinforced thermoplastic pre-pregs for use in lightweight structural applications
- Composite materials can be tailored for:
  - Exceptional toughness
  - Environmental resistance
  - Vibration dampening
  - Low flammability characteristics
  - High wear resistance
  - Radiolucency/x-ray transparency
<table>
<thead>
<tr>
<th>Matrix Polymer</th>
<th>Nominal Processing Temp °C/°F</th>
<th>Tg °C/°F</th>
<th>Polymer Structure</th>
<th>Polymer Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyetheretherketone (PEEK)</td>
<td>385/725</td>
<td>143/290</td>
<td>Semi-crystalline</td>
<td>250/480</td>
</tr>
<tr>
<td>Polyetherimide (PEI)</td>
<td>320/610</td>
<td>215/420</td>
<td>Amorphous</td>
<td>200/390</td>
</tr>
<tr>
<td>Polyphenylene Sulfide (PPS)</td>
<td>330/625</td>
<td>90/195</td>
<td>Semi-crystalline</td>
<td>220/430</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>190/375</td>
<td>-10/-14</td>
<td>Semi-crystalline</td>
<td>90/194</td>
</tr>
<tr>
<td>Polyethylene (PE)</td>
<td>175/350</td>
<td>-125/-195</td>
<td>Semi-crystalline</td>
<td>70/160</td>
</tr>
<tr>
<td>Polycarbonate (PC)</td>
<td>295/565</td>
<td>150/302</td>
<td>Amorphous</td>
<td>130/265</td>
</tr>
<tr>
<td>Polyethylene terephthalate (PET)</td>
<td>290/555</td>
<td>75/165</td>
<td>Semi-crystalline</td>
<td>130/265</td>
</tr>
<tr>
<td>Polyether Sulfone (PES)</td>
<td>290/555</td>
<td>225/435</td>
<td>Amorphous</td>
<td>180/355</td>
</tr>
<tr>
<td>Polybutylene Terephthalate (PBT)</td>
<td>265/510</td>
<td>56/135</td>
<td>Semi-crystalline</td>
<td>110/230</td>
</tr>
<tr>
<td>Polyamičes (Nylon) (PA 12, PA 11, PA 6.10, PA 6, PA 4.1)</td>
<td>190-220/375-430</td>
<td>40-60/105-140</td>
<td>Semi-crystalline</td>
<td>120/250</td>
</tr>
<tr>
<td>Polyetherketoneketone (PEKK)</td>
<td>355/670</td>
<td>156/315</td>
<td>Semi-crystalline</td>
<td>230/445</td>
</tr>
</tbody>
</table>