Central Manufacturing Technology Institute (CMTI), Bangalore has established facilities for Additive Manufacturing (AM). It offers total solution for Additive Manufacturing and consultancy.

CMTI is equipped with

- **Direct Metal Laser Sintering (DMLS)** AM machine - EOSINT M250 Xtended from M/s Electro Optical Systems, Germany (Build size: 250 X 250 X 150 mm).
- 5-Axis **Direct Metal Deposition (DMD)** AM machine - DMD 105D from M/s POM, USA (Build size: 300 X 300 X 300 mm).
- **Magics software** for preprocessing of CAD models.
- **CAD/CAM software** - Unigraphics & DMDCAM.

### METAL ADDITIVE MANUFACTURING

1. **DIRECT METAL LASER SINTERING (DMLS) AM TECHNOLOGY**

Direct Metal Laser Sintering is an additive manufacturing process that uses a laser beam to fabricate metal parts by sintering of metal powders, smeared on a substrate with a recoater system.

#### 1.1 SALIENT FEATURES OF DMLS MACHINE

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Make &amp; Model</strong></td>
<td>EOSINT M250 Xtended AM Machine, M/s EOS GmbH, Germany</td>
</tr>
<tr>
<td><strong>Laser</strong></td>
<td>CO₂ Laser, 240 W</td>
</tr>
<tr>
<td><strong>Build Size</strong></td>
<td>250 X 250 X 150 mm</td>
</tr>
<tr>
<td><strong>Metal Powders</strong></td>
<td>Steel, Bronze-Nickel</td>
</tr>
<tr>
<td><strong>Layer thickness</strong></td>
<td>20 µm</td>
</tr>
<tr>
<td><strong>Surface Roughness</strong></td>
<td>Ra 10 µm</td>
</tr>
<tr>
<td><strong>Dimensional Accuracy</strong></td>
<td>± 100 µm</td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td>40 – 45 HRC</td>
</tr>
<tr>
<td><strong>Porosity</strong></td>
<td>&lt; 0.5%</td>
</tr>
<tr>
<td><strong>Tooling for Plastic Moulds</strong></td>
<td>Tool life upto 10 lakh parts</td>
</tr>
<tr>
<td><strong>Tooling for Diecasting</strong></td>
<td>Tool life upto 5000 parts</td>
</tr>
</tbody>
</table>
1.2 DMLS APPLICATIONS

DMLS APPLICATIONS

METAL PARTS
- Functional Testing
- Form & Fit

DIES & MOULDS
- Plastic Moulding
- Diecasting
- Investment Casting
- Rubber Moulding
- Metal Stamping

SPECIAL APPLICATIONS
- Conformal Cooling Channel
- Lattice Structures
- Bionic Structures

NEW MATERIALS
- Metal Matrix Composites
- Alloys

1.3 DMLS APPLICATIONS – EXAMPLES

- Mold (Medical application)
  - Core Size: 193x66x30mm
  - Cavity Size: 193x66x37mm
  - Build time: 13 hours

- 1:30 Scale Aircraft Model
  - Size: 500x200x300mm
  - Build time: 100 hours

- Forming Tool For Copper coil
  - Size: 87x52x30mm
  - Build time: 12 hours

2 5-AXIS DIRECT METAL DEPOSITION (DMD) AM TECHNOLOGY

Direct Metal Deposition is an additive manufacturing process that uses a high power laser to fabricate fully dense metal parts by melting metal powders fed through a nozzle.

5-AXIS DMD 105D MACHINE

- Make & Model: 5-Axis DMD 105D AM Machine, M/s POM Inc., USA
- Laser: Diode Laser, 1000 W
- Build Size: 300 x 300 x 300 mm
- Metal Powders: Stainless Steel, Inconel, Titanium, Cermet, Nickel, Iron Super alloys etc.
2.1 SALIENT FEATURES OF 5-AXIS DMD 105D MACHINE

- 5- Axis Metal Deposition Capability
- DMDCAM Software for 5-Axis Deposition Path Generation
- Closed Loop Feedback System to monitor layer thickness
- DMD Vision System for image capturing and automatic NC tool path generation
- Integrated DMD Technology Database for process parameters
- Pyrometer for melt pool temperature measurement

2.2 DMD APPLICATIONS

<table>
<thead>
<tr>
<th>CONFORMAL COOLING</th>
<th>HARDFACING/COATING</th>
<th>REMANUFACTURING</th>
<th>SPECIAL APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diecasting</td>
<td>Oil Industry</td>
<td>Turbine Components</td>
<td>Bimetallic components</td>
</tr>
<tr>
<td>Plastic Injection Moulding</td>
<td>Wood Industry</td>
<td>Large components with large lead-time</td>
<td>Lattice structures</td>
</tr>
<tr>
<td></td>
<td>Stamping</td>
<td>Expensive Components</td>
<td>Valve seat cladding</td>
</tr>
<tr>
<td></td>
<td>Trimming</td>
<td>Small Engineering changes</td>
<td>Functionally Graded Materials</td>
</tr>
<tr>
<td></td>
<td>Forging</td>
<td></td>
<td>New Materials</td>
</tr>
</tbody>
</table>
2.3 DMD APPLICATIONS - EXAMPLES

3. ADVANTAGES OF ADDITIVE MANUFACTURING

- Quick design iteration for product finalization.
- Drastic reduction in lead-time for product development.
- Direct tooling for mass production/ pilot batch.
- Rapid manufacture of prototypes with complex shapes impossible to manufacture by conventional methods.
- Enables full customization in prototypes along with higher freedom of design.
- Rapid manufacture of prototypes for conceptualization, analysis and testing.

4. SERVICES OFFERED BY ADDITIVE MANUFACTURING TECHNOLOGY

- Additive Manufacturing & Rapid Tooling for realization of prototype components, moulds, etc.
- Applied Research opportunities in Additive Manufacturing for industries and academia.
- Training programmes in Additive Manufacturing for personnel from industries and academia.

5. BENEFICIARY INDUSTRIES

Aerospace, Automobile, Medical, Defence, Nuclear, Oil & Gas, Tooling, Electrical, Electronics, Architecture, Paper & Pulp, Watch, Toy industries, etc.

For Specific Queries, Please Contact:

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