Advanced Manufacturing Processes (AMPs)

Advanced Additive Manufacturing Processes

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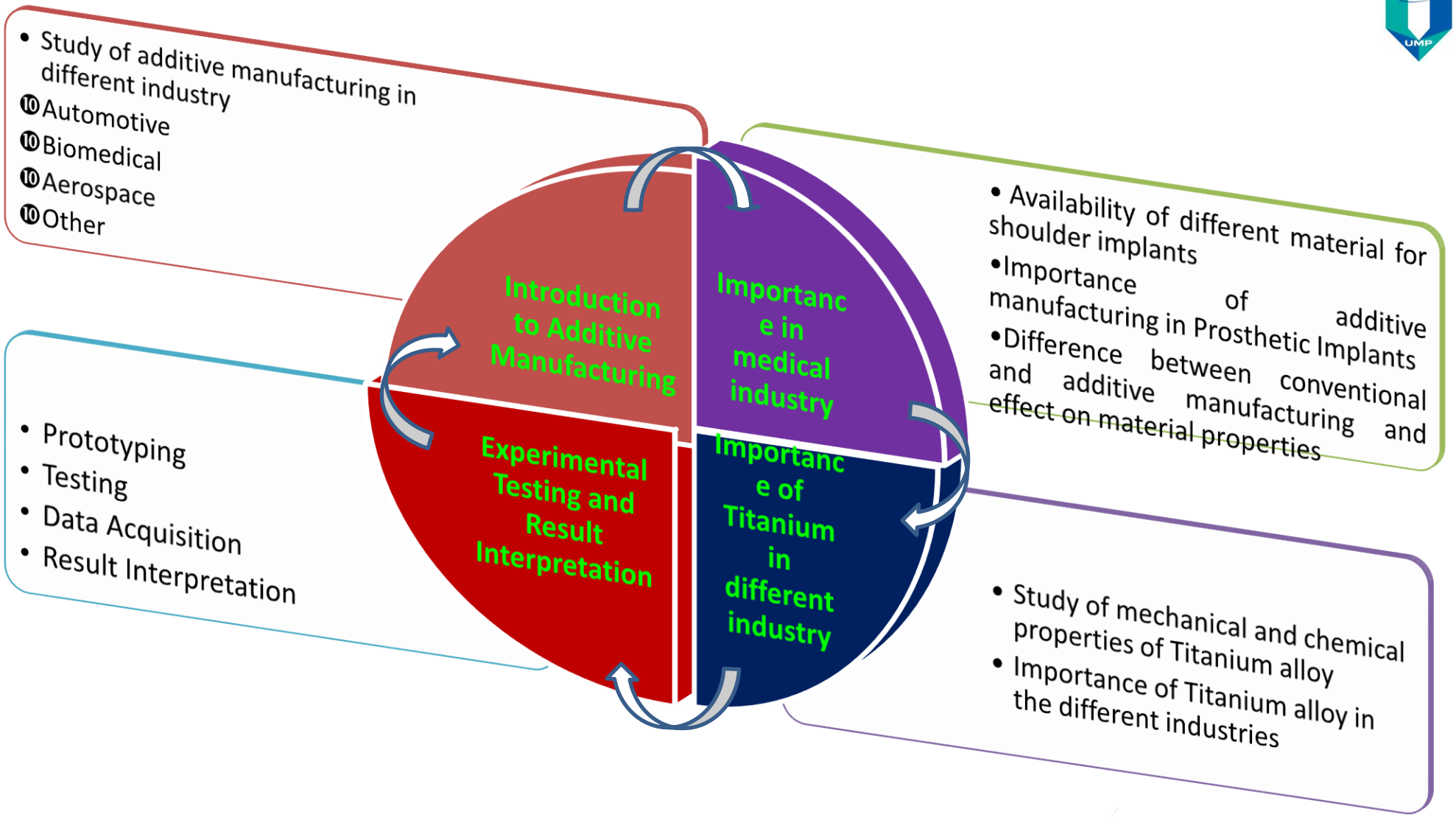
- Aims
  - To provide and insight on advanced Additive Manufacturing Processes (AAMP)
  - To provide details on why we need AAMP and its characteristics

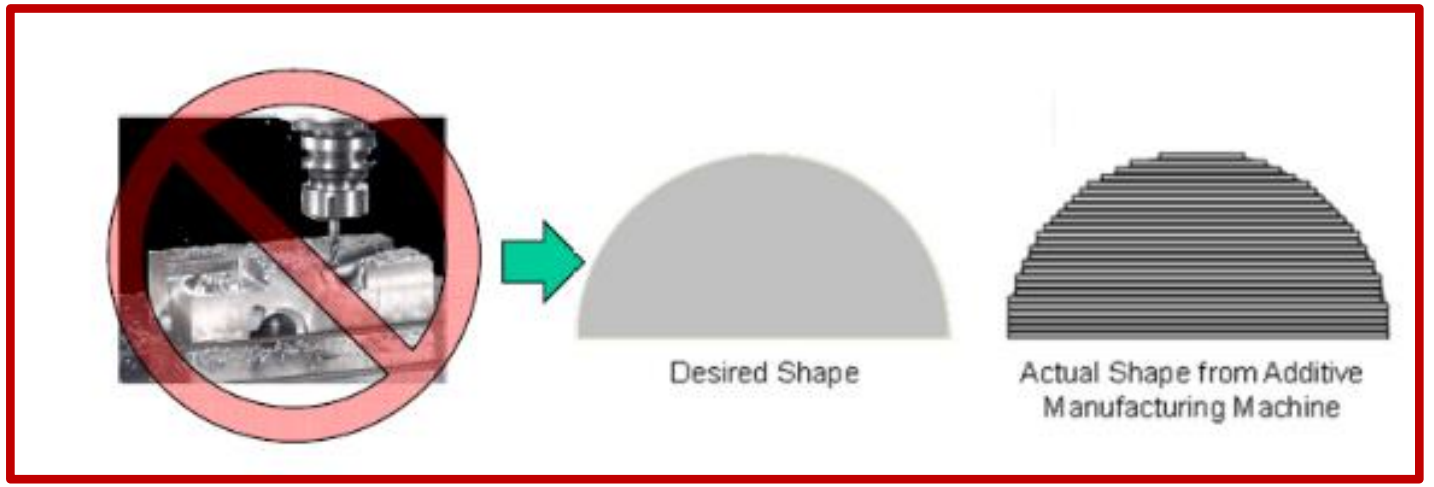
- Expected Outcomes
  - Learner will be able to know about AAMPs
  - Learner will be able to identify role of AAMPs in todays sceneries

- Other related Information
  - Student must have some basic idea of conventional manufacturing and machining
  - Student must have some fundamentals on materials



Additive Manufacturing

- The ASTM F42 technical committee defines additive manufacturing (AM) as the process of joining materials to make objects from 3D model data usually layer upon layer *(Nannan GUO et al.)*
- This technique is distinguished from traditional subtractive machining technique



Basic Principle of Additive Manufacturing

Design

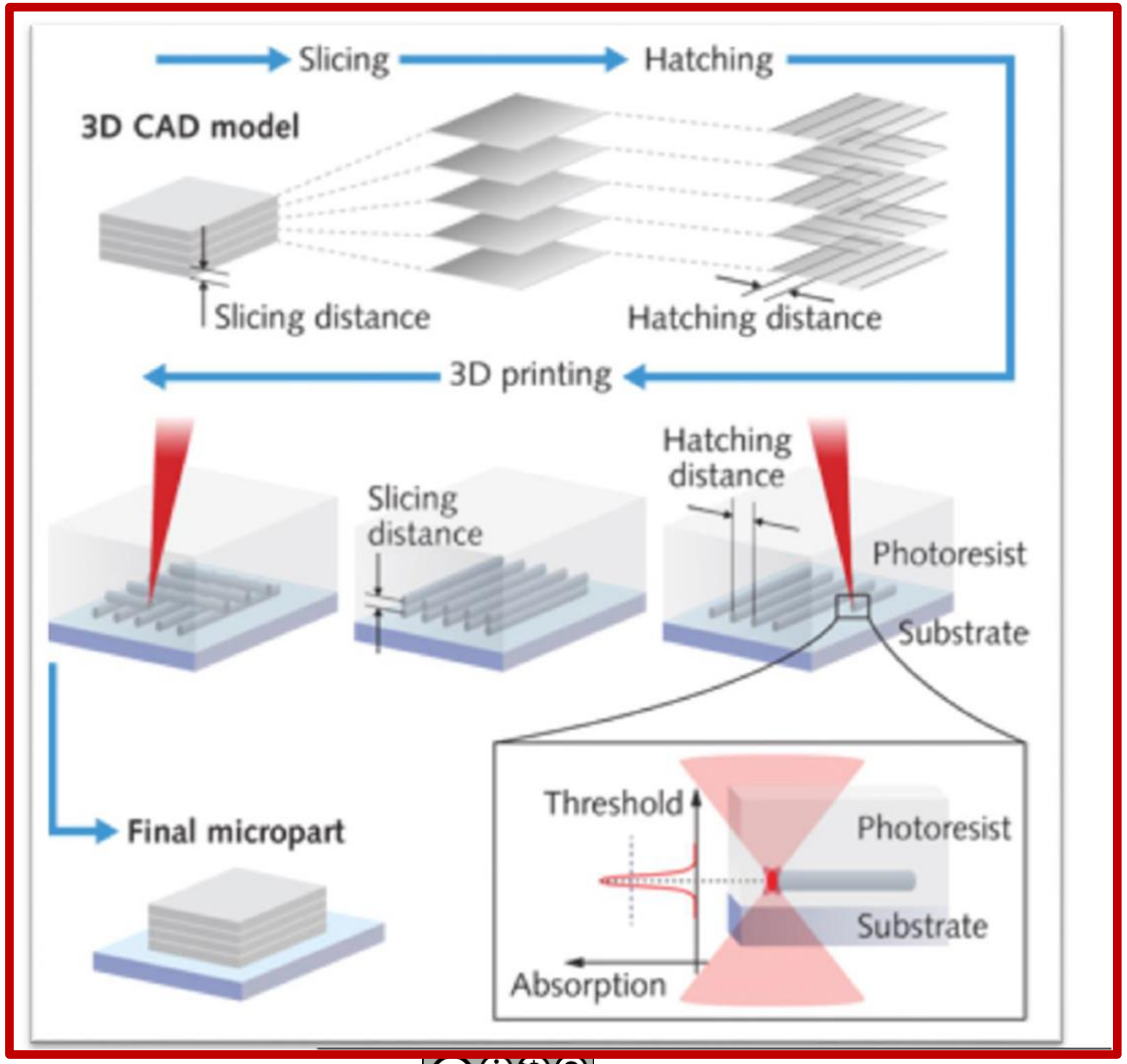
A digital model of the object is issued and converted into a STL file

Print

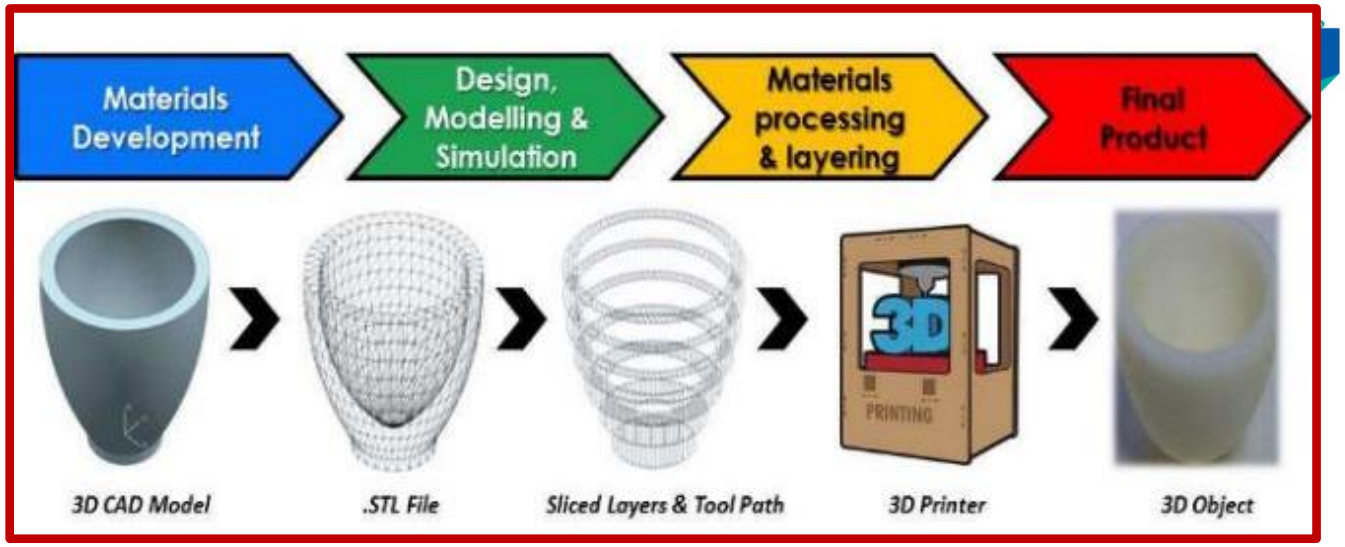
3D Printer slices file into numerous digital cross sectional, and builds the model by joining together successive layers

Finish

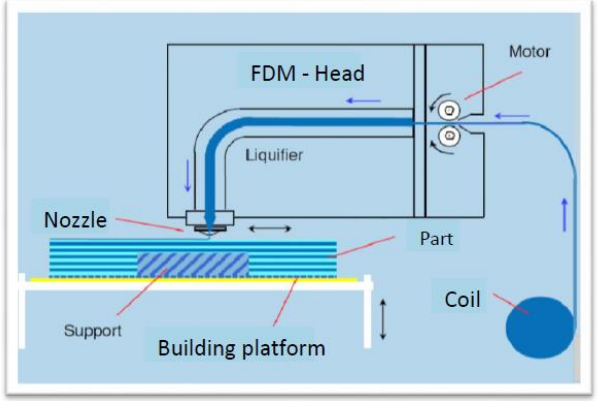
Final 3D printed model is cleaned to remove overhung material and is polished/ painted and made ready for use

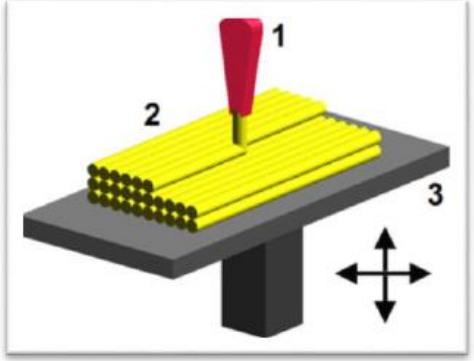


Functional Principle of Additive Manufacturing



- Technology
  - Laser/ LED
    - Stereolithography
    - Selective Laser Sintering
    - Carbon 3D
    - Selective Laser melting
  - Extrusion
    - Fused deposition Modeling





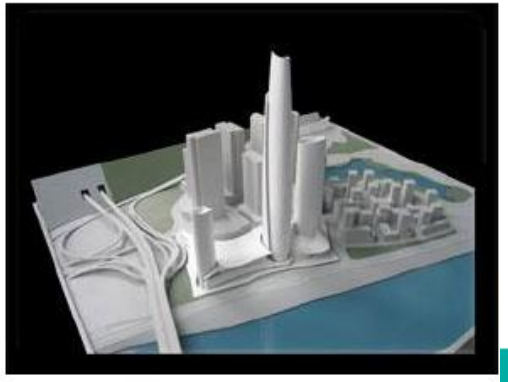
Fused Deposition Modeling (FDM)

How it works ?

- A wired shaped material is melted in a high temperature nozzle
- Plotter mechanism
- Hard layer of plastic or metal filament can be created
- Multiple jetting possible

Materials

- Thermoplastics (ABS)
- Polyphenylsulfone
- Polycarbonate
- Ceramics



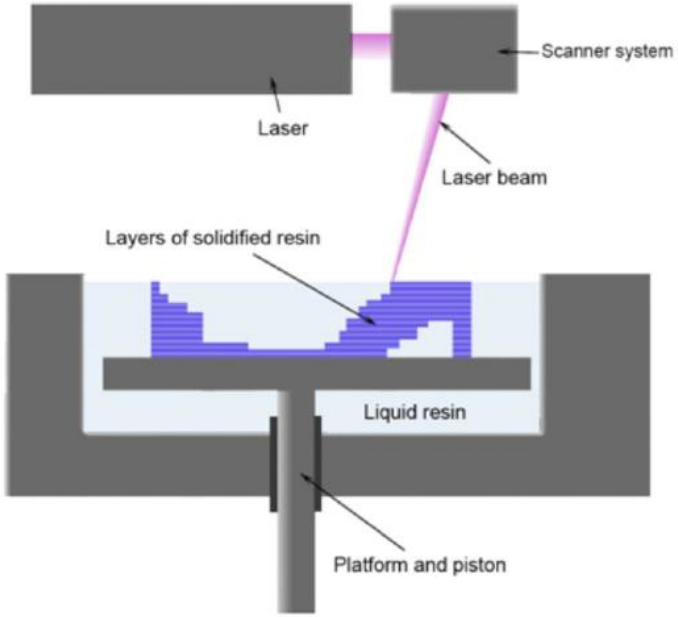
Advantage

- Low cost
- Dual jetting possible

Disadvantage

- Slow process
- Inconsistent material due to the construction in layers

Stereolithography (SLA)

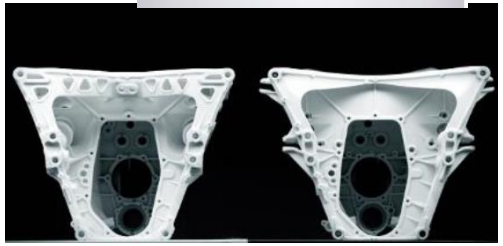


How it works ?

- Based on photopolymerization
- Photo reactive resin is cured by using UV laser

Materials

- Epoxy based photopolymers
- Thermoplastics (ABS)

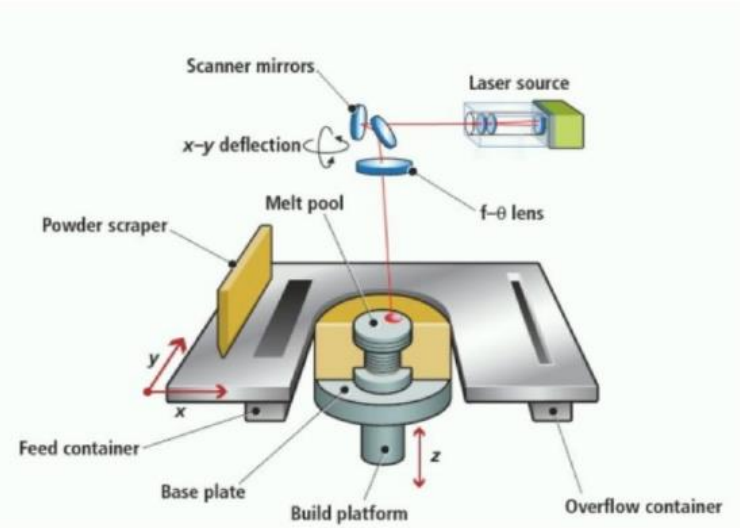


Advantage

- Good for complex geometries
- High resolution

Disadvantage

- Time consuming



Selective Laser Melting (SLM)

How it works ?

- Metal powder and metal wires get melted
- Adding layer by layer
- Stainless steel, Titanium and special alloy

Materials

- Stainless steel and tool steel
- Titanium
- Aluminum
- Other metal alloys

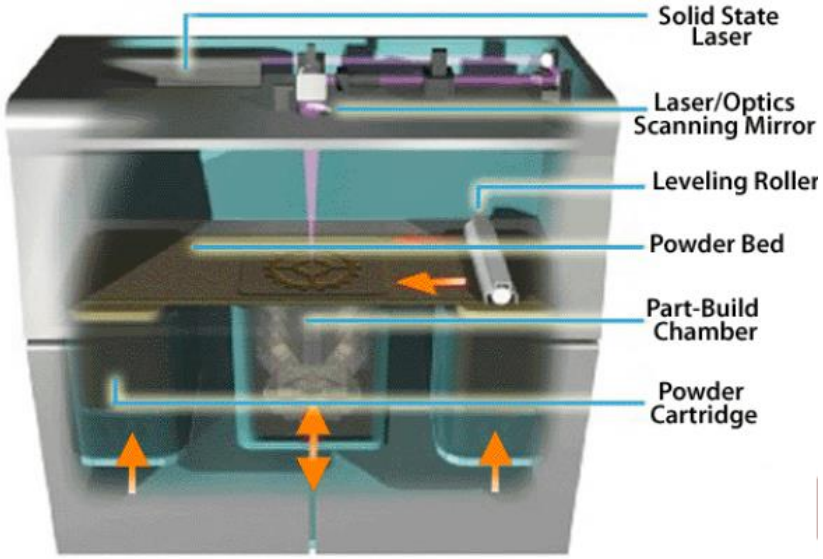
Advantage

- Physical behavior like in conventional production

Disadvantage

- Expensive

Selective Laser sintering (SLS)



How it works ?

- High Power laser fixes powders in a solid bond
- Plastic, glass powder, ceramic
- Powder functions also a supporting material

Materials

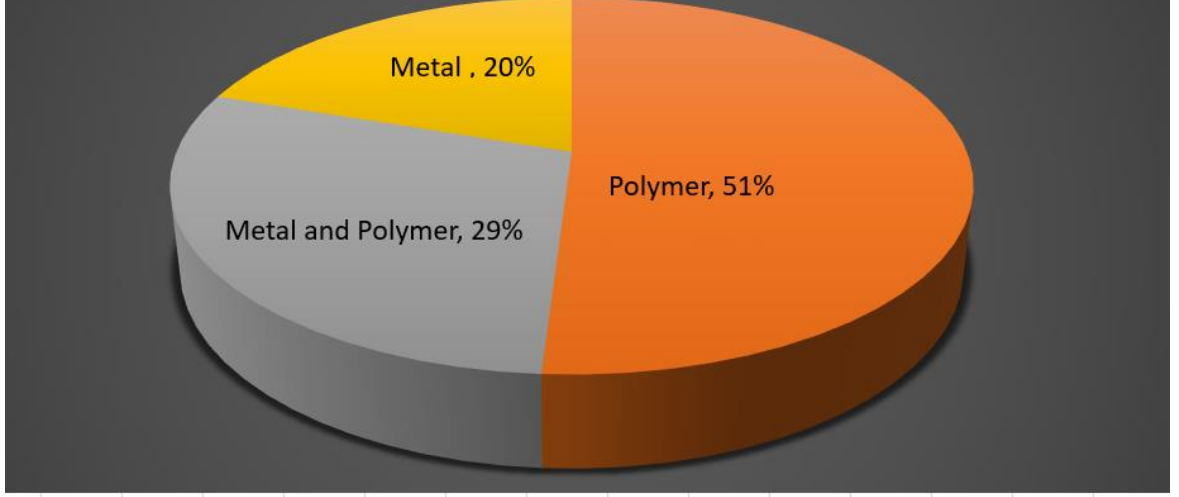
- Metal Alloys
- Composites
- Ceramics
- Carbon Fibers
- Engineering Plastics

Advantage

- Complex structures are possible

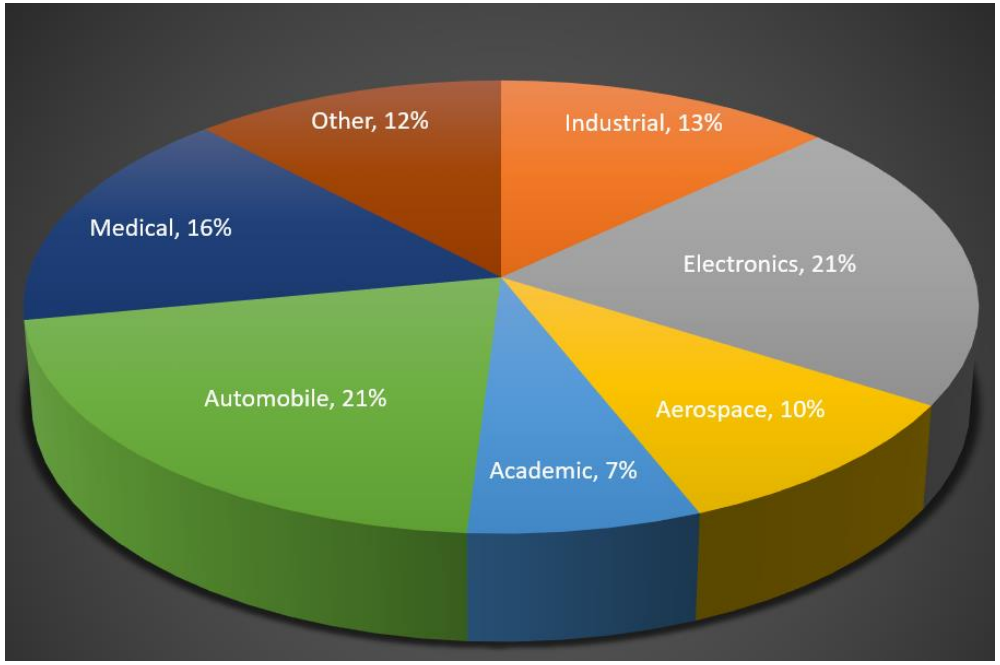
Disadvantage

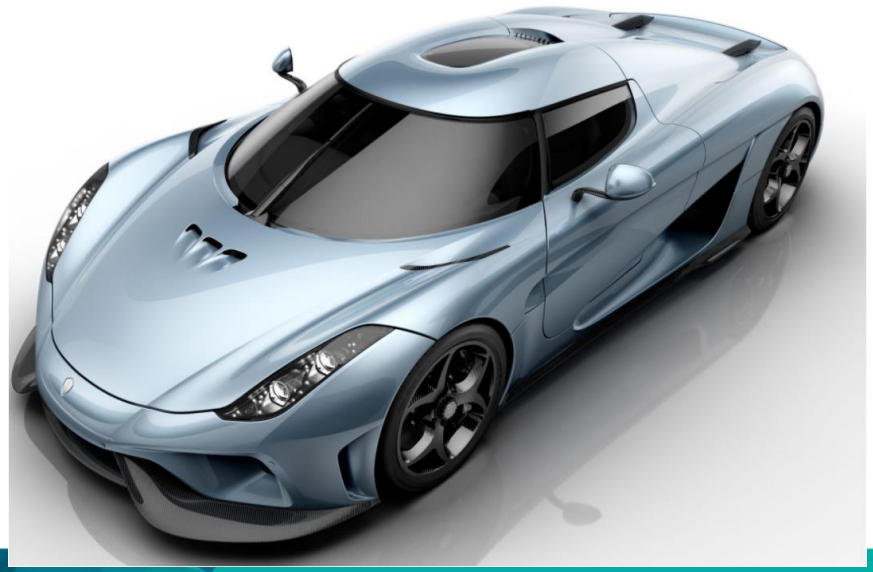
- Expensive



Commonly Used Materials

- Commonly used materials
  - Plastics
    - Bioplastics
    - Composites
      - Thermoplastics
      - Thermosets
  - Metals
    - Stainless Steel
    - Titanium
    - Aluminum
  - Others
    - Photopolymers
    - Resin
    - Ceramics





Additive Manufacturing Industries

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