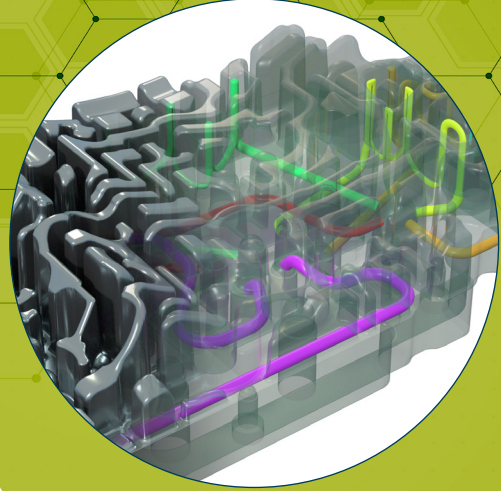


# ADDITIVE MANUFACTURING



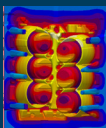
Additive manufacturing can thermally improve die casting conditions, resulting in reduced cycle times and extended tooling life. This is accomplished by conformal cooling channels which were impossible with conventional manufacturing processes.

We can accommodate up to 100 kg or 400 mm x 400 mm x 400 mm part. A proprietary heat treatment systems is also in-house to guarantee consistency and short lead times.

## UPON REQUEST THERMAL SIMULATION CAN BE PROVIDED

- There are various ways of additively manufacturing metal parts, each with its own strengths and weaknesses.
- Processes differ:
  - Feedstock material type
    - \* Wire, powder, sheets, adhesives, etc.
  - Material feeding method
    - \* Wiping, raining, inkjet, nozzles, etc.
  - Energy source
    - \* Lasers, UV, electron beam, etc.
- All have their purposes, you just need to understand the process and applicable uses.

*All have their purposes, you just need to understand the process and applicable uses.*

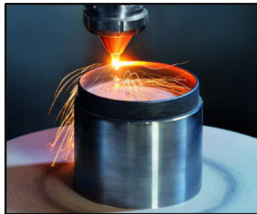


## THE PERFECT DIE

Requires the die and shot end temperature to be stable from the first to the last casting.

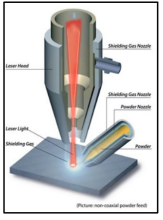


## DIRECT ENERGY DEPOSITION



### ADVANTAGES

- Can be done with powders or wires
  - Deposition rate with wire up to 3 kg/hr.
  - Power deposition rate up to 2 kg/hr.
- Does not require starting on flat plane, full 5-axis control with deposition head.
- More material options.



### DISADVANTAGES

- Minimum features sizes are 1-2 mm.
- Only extremely simple water channel possibilities, if any.
- Greater porosity in part (up to 2%)

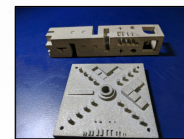
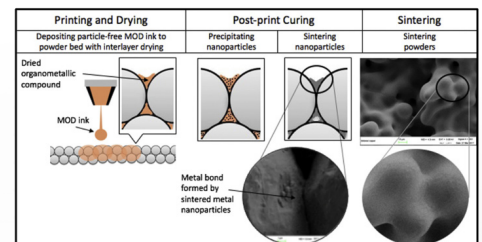
## BINDER JETTING

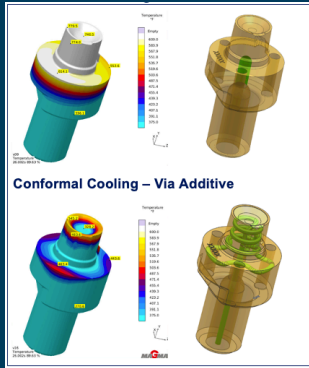
### ADVANTAGES

- Printing speeds are fastest among AM techniques (up to 50 kg/hr).
- Adhesive resin joining powder particles means greater material library.
- Can stack many parts in one build, no need to attach to a build plate.
- No need for support structure.

### DISADVANTAGES

- Part come out 'green'
  - Require special heat treatment to burn out the resins/glues.
  - Uncontrollable shrink and warpage.
- Greatest level of porosity due to evacuating resins/glues (~3%)
- Lowest material properties.
- Parts greater than 50 mm not recommended due to post-processing.





### ADVANTAGES OF CONFORMAL COOLING

- Getting water closer to the cavity surface
- Thermal balance and control
- Cycle time reduction
- Decreased scrap rates
- Increased die uptime

### ADVANTAGES OF 3D PRINTING

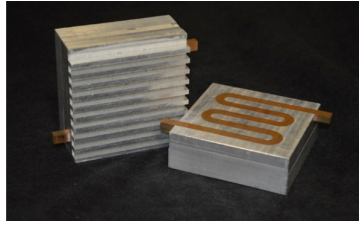
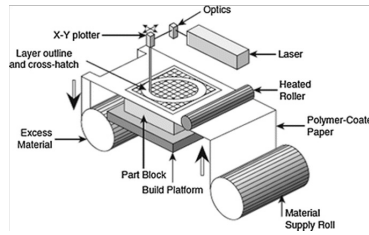
- Design freedom
- Simplified die design
- Less wasted material
- Minimized machining



✉ sales@castool.com

☎ +1.905.852.0121

## SHEET LAMINATION/DIFFUSION BONDING



### ADVANTAGES

- Hybrid of subtractive and additive techniques.
- Most cost competitive.
- Only limitation in size is your milling machines and furnaces.
- Diffusion bonding the sheets together creates fairly uniform parts.

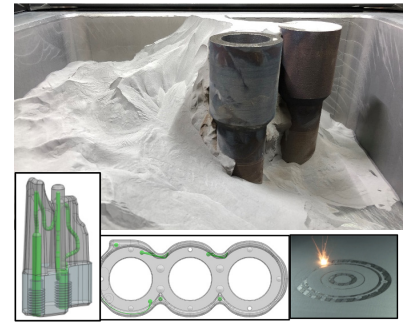
### DISADVANTAGES

- Can not create true conformal cooling lines (lines are mostly square/sharp due to milling steps).
- Greater number of internal stress risers.
- Risk of crack propagation from layering process.

## DIRECT METAL LASER SINTERING

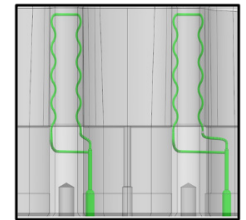
### ADVANTAGES

- Capable of printing fine feature as well as extremely complex shapes.
  - True conformal cooling
- Better surface finish (10-20 µm)
- Can keep adding lasers to increase speed, mass production.
- Fully dense parts (up to 99.95% dense).



### DISADVANTAGES

- Slow compared with other 3D printing techniques (0.15 kg/hr per laser).
- Large beds (>300 mm) make it difficult to evenly spread powder.
- Most development dedicated to Al, Ti for aerospace and medical industry.
- Overhangs greater than a few mms not possible.



*Power Bed Fusion Technology is the only viable method available on the market capable of producing the complex shapes*

