Additive Layer Manufacturing

Near net additive manufacturing is a process by which material is selectively added in order to form a component. This is in direct contrast to traditional manufacturing processes such as machining where material is removed from a billet to produce a component. Unlike processes such as machining, the material not used in the manufactured component can be reused and some additive manufacturing techniques can achieve 90-95% material utilisation. This makes it a very appealing processing route for high value materials.

Metallic additive manufacturing encompasses many manufacturing techniques including:

- Blown powder systems.
- Powder bed systems.
- Semi-solid forming – thixoforming.
- Metal injection moulding (MIM).
- Wire fed systems.
- Ultrasonic consolidation.
- Net shape hot isostatic pressing (HIP).

The ARCAM S12 system utilises an high power electron beam (E-beam) to deposit complex metallic components using additive layer powder-bed technology where metallic powders are deposited in (typically) 100μm layers and selectively melted with the E-beam until the entire component has been deposited layer by layer, working directly from the components CAD file.

E-beam manufacturing is carried out hot and under vacuum, enabling the production of fully dense, highly complex geometries in reactive and traditionally difficult to manufacture materials. Such a near net technique can drastically decrease residual stress, machining time, material costs, manufacturing steps and lead time. In addition to this, geometries that can not be manufactured by any other manufacturing process can easily be achieved with this technique.

Materials that can be currently E-beam deposited:

- Titanium alloys
- Cobalt-Chrome alloys
- Titanium aluminides
- Nickel based super alloys
- Aluminium
- Tool steel
- Stainless steel
- Tool steel
- Hard metals (including Tungsten)
- Amorphous metals
- Copper
- Niobium
- Beryllium

The EOS M270 powder bed system operates under the same principle as the Arcam S12, however, the powder size and layer thickness are smaller at 20-40μm. These powder layers are selectively melted under an inert gas atmosphere with a precisely controlled fibre laser and produces excellent component surface finish, tolerances and resolution. Subsequent annealing and heat treatments can produce mechanical properties comparable to wrought materials.

Materials that can be currently laser deposited:

- Stainless steel
- Cobalt-Chrome alloys
- Titanium alloys
- Bronze-nickel alloys
- Tool steels
- Nickel based super alloys