Near Net Shape Manufacturing

Near Net Shape (NNS) manufacturing technologies have the potential to displace existing technologies with benefits including reduced material waste and increased part complexity. But while NNS technologies currently use metal alloys designed for traditional manufacturing methods, there is a need to design specific alloys for these resource-efficient process routes.

Royce@Sheffield offers a wide range of state-of-the-art Additive Manufacturing (AM) machines that have open source software with full instrumentation allowing complete control of the manufacturing process and therefore ability to optimise for new alloys.

Electron Beam Melting (EBM) - Q10plus and Q20plus (Arcam)
Our Arcam EBM machines build fully dense metal components using a high power electron beam. The process takes place in a vacuum and at high temperature. Both machines have the latest generation EB gun, which allows for higher productivity and improved resolution. It also includes Arcam LayerQam™, a camera-based monitoring system for inline part quality verification.

The Q10plus has a maximum build size of 200 x 200 x 180mm, making it ideal for the cost-effective production of orthopaedic implants, the development of materials and rapid prototyping of small components.

The larger Q20plus is developed for easy powder handling and fast turnaround times. With an extended build volume (350 x 380mm (Ø/H), it is ideal for larger parts such as aerospace components.

Laser Powder Bed Melting - ACONITYMINI and ACONITYLAB (ACONITY3D GmbH)
Our laser powder bed fusion AM systems are the ACONITYMINI and ACONITYLAB. They both use a laser beam to selectively melt an area of metal powder based on a 3D model of a component, then repeating it layer by layer until the final geometry is obtained.

The machines are unique in that they are reconfigurable, both in terms of software and hardware. This enables the user to have complete freedom and control over the various processing parameters we can use, as well as the ability to change the machine components. This means that they are well suited for research purposes and will provide the opportunity to significantly enhance the scope of projects and better understand the process parameters.

The ACONITYMINI is an entry-level laboratory system with a build volume of Ø 140mm x H 200mm and is designed for efficient material research. It can be equipped with a preheating device, process monitoring or changed laser configuration.

The ACONITYLAB is a truly modifiable lab system which can either be equipped with process monitoring tools, vacuum option or high-temperature preheating of up to 1200°C. Its build volume is Ø 170mm x H 200mm.
Directed Energy Deposition - Magic 2.0 (BeAM)

Directed Energy Deposition (DED) is an AM process where focused thermal energy is used to fuse materials by melting them as they are deposited. In this system, a deposition nozzle mounted on the Z-axis of a DED dedicated CNC (computer numerical control) machine is used. This allows continuous 5 axes of freedom to build/repair components layer by layer without the need for support structures.

Royce@Sheffield’s BeAM Magic 2.0 is a blown powder AM machine. Blown powder AM is commonly used by the aerospace sector to repair high-value components. The machine’s capabilities include creating new alloys in situ so the properties of the deposited material can be changed during the build process. The build volume is 1200 x 800 x 800 mm.

Bound Metal Deposition™ - Studio System™ (Desktop Metal)

The Studio System is a three-part solution that automates metal 3D printing. Tightly integrated through Desktop Metal’s cloud-based software, it delivers a seamless workflow for printing complex metal parts in-house - from digital file to sintered part.

From CAD file, layer by layer, a green part is shaped by extruding bound metal rods - metal powder held together by wax and polymer binders - in a process called Bound Metal Deposition™, or Material Extrusion. The green part is then immersed in proprietary debind fluid, dissolving primary binder and creating an open-pore channel structure throughout the part in preparation for sintering. As the part is heated to temperatures near melting, remaining binder is removed and metal particles fuse together causing the part to densify.

This is an exciting, office-friendly metal 3D printer with great capabilities and a scalable design for increased throughput.