Powder Production

Powder production is a vital part of what we do at Royce@Sheffield. Near Net Shape (NNS) manufacturing technologies, including Additive Manufacturing (AM) - or 3D printing, are increasingly being used by key industries such as aerospace, automotive and bio-medical to produce and modify complex parts and components. But the alloys currently being used in AM are entirely conventional, designed for the traditional cast and wrought route and, in the majority of cases, they are not optimised for this purpose.

Our aim is to develop novel, bespoke alloys in small powder batches using our range of state-of-the-art powder production equipment, which can be trialled and evaluated in the various NNS technologies in order to achieve the optimum feedstock for each process. Our facilities enable us to produce metal powders using atomisation and milling, before the resulting powders are optimised through the spheroidisation process.

Gas Atomisation - ATM DM 50 (Arcast Inc.)
Gas atomisation produces spherical powders from metals such as titanium, iron, copper, nickel and cobalt-based alloys, which have a high cleanliness level and are ideal for use in AM. Our inert gas atomiser incorporates induction melting capabilities to manufacture high quality, technically advanced metal powders from titanium alloys and highly reactive, refractory metals. Typical bar size is between 200mm and 1000mm and charge mass is 8-50kg, while the typical resulting powder size is between 20 to 150µm. The atomisation chamber is stainless steel with 150mm view ports.

Attrition Milling - HD-01 and S-1 (Union Process)
Attrition milling provides fast, efficient and reliable fine grinding of media including carbon steel, stainless steel, chrome and tungsten carbide. They are more appropriate for mid-range size particles.

The HD-01 is a research attritor ideal for formulation, quality control and scale-up studies. Results are repeatable from one test grind to another for maximum credibility. Designed for media from ⅛” to ¼”, it can be used for wet or dry grinding with shaft speeds from 100 to 650 RPM. With this machine, we are able to introduce an inert gas, overcome product contamination, change media size and type, and obtain precise energy consumption. The end product size can be as fine as 2-3 microns when operating in batch mode.

The S-1 is a versatile, laboratory-size machine designed to meet virtually all lab grinding and dispersing needs - either wet or dry. Easy to scale up to production size with reproducible results from batch to batch, it is also suitable for small production or pilot plant work. It is designed for media ranging from ⅛” to ⅜” and runs at speeds of 100 to 500 RPM.
Plasma Spheroidisation - TEKSPHERO-15 (Tekna)

Spheroidisation uses high energy plasma to create highly spherical and dense metal powders from those produced by sintering, grinding and atomisation techniques, providing more consistent results. Spherical powders have better flowability inside an AM machine, meaning less downtime and faster production.

Spheroidisation reduces internal porosity and provides higher packing density, while removing contamination and increasing purity. Removing excess oxygen from the material helps to improve mechanical properties in the completed part or component.

The TEKSPHERO-15 enables us to meet the most demanding powder metallurgy applications including AM, metal injection moulding and hot isostatic pressing. The powder developed at 15kW can easily be scaled up for production at higher power levels. It has a feed rate of up to 1kg/h and can produce powder sizes of up to 200µm. The machine is suitable for processing refractory metals such as tantalum, tungsten, titanium, molybdenum and niobium, as well as nickel-based superalloys.