

Quantitative Shape Analysis of Metal Powder Samples by Morphology

Why use quantitative shape analysis for Additive Manufacturing applications?

The shape of a metal powder can greatly affect its flowability and packing density. The accurate and objective validation of the powder's morphology is a valuable tool in its characterisation for additive manufacturing (AM), particularly for critical applications such as aerospace, medical and automotive, and also supports the powder's history and traceability.

A powder with spherical particles will generally have better flow properties and a greater packing density than one with irregular shaped and/or heavily satellited particles. Non-spherical particles are more likely to interlock which can cause bridging, disrupting powder flow into the dosing mechanism of the AM machine by clumped particles, compromising the even spread of powder layers in the machine.

A consistent powder that flows predictably enables the end user to optimise parameters on an AM machine to achieve desired properties in the final built part. Monitoring particle morphology gives assurance of consistency across batches, contributing to the reproducibility of results. If a powder has been used in a prior build, quantitative shape analysis can measure the changes in its morphology, highlighting any need for reprocessing.

Why choose morphology?

The morphology system employed by LPW uses static image analysis to measure particle size and shape from 0.5 μm – 1000 μm . It evaluates circularity, circular equivalent (CE) diameter, aspect ratio, convexity, elongation, and solidity, reporting minimum, maximum, mean, Dv10, Dv50, Dv90, standard and relative standard deviation values.

Some common tests are subjective, such as SEM imaging, and rely on the interpretation of results by the user. Quantitative shape analysis is an automated process which provides objective, user-independent results which are more reproducible than non-quantitative techniques.

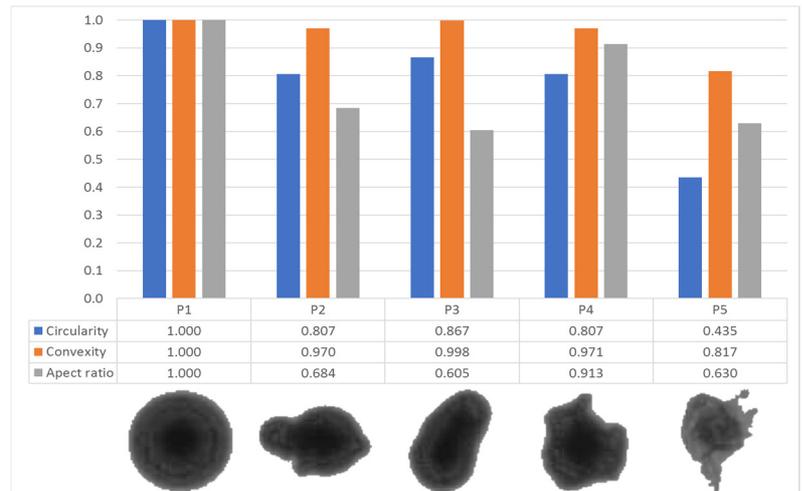


Quantitative shape analysis methodology

The test is undertaken in a laboratory environment using specialised equipment which self-calibrates before each analysis. From the 100g sample submitted, a subsample is evenly dispersed onto a glass slide using energy-controlled compressed air. A high-quality optical microscope and camera capture images of typically 10,000 individual particles.

Combining the photographic images and the data results, gives an effective overview of the metal powder characteristics.

The technique is often used in conjunction with laser size diffraction and sieve analysis to gain a deeper understanding of metal powder behaviour.



Additional metal powder and Additive Manufacturing testing services

LPW’s PowderLab offers a complete suite of tests for enhanced characterisation of powders, fully optimised for specific applications. With our metal 3D printing industry expertise, we can test AM components in validation studies and root cause analysis of failed builds.

Chemical analysis

- Oxygen, nitrogen, and hydrogen analysis by Inert Gas Fusion
- Elemental analysis/Contamination screening (EDX)
- Moisture analysis by Karl Fischer titration

Full Chemical Analysis is available including residual elements and interstitials using various techniques as appropriate, undertaken by ISO17025/Nadcap Approved Lab

Physical analysis

A range of physical tests is available including:

- Apparent/Bulk Density (measurement according to ASTM B212)
- Tap Density (ASTM B527)
- Hall Flow (ASTM B213)
- Carney Flow (ASTM B964)
- Angle of Repose (LPW standardised internal procedure)
- Sieve Analysis (ASTM B214)
- Particle Size Distribution by Laser Size Diffraction (ASTM B822)
- Powder Imaging (SEM)
- Powder Cross-Section/Porosity Imaging (SEM)
- Metallographic sample preparation & examination (SEM)
- Rheometry and Shear Cell Analysis
- True Density by Helium Gas Pycnometry (ASTM B923)
- Quantitative Shape Analysis (Optical & SEM)

All our testing is undertaken to relevant ASTM as standard with ISO available on request, adding consistency and confidence to your process.

For further information on any of our analytical testing services, please contact your local LPW office at www.lpwtechnology.com/contact-us/ or email sales@lpwtechnology.com