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Fine-graining for Particle Shape Characterization

Purdue Researchers have developed a method for characterizing particle shapes for additive manufacturing (AM), particularly in powder bed fusion processes. The image analysis technology benefits any powder processing applications involving flow and packing of powders by improving 2D particle image resolution for shape analysis. Digital image resolution and pixilation are known to impact the precision of particle perimeter and shape measurements, which can lead to inconsistencies at low pixel scales. This technology developed at Purdue addresses these limitations by correlating porosity with particle shape characteristics and providing insights into how particle shape affects material behavior during manufacturing. Moreover, this method promotes better control over porosity in feedstock powders, thereby enhancing the mechanical properties of final AM products.

Technology Validation:

Principal component analysis of shape descriptors was used to identify clusters and rank individual shape descriptors in terms of their effectiveness in shape differentiation. Results showed that over 90% of shape effects can be described with two principal components.

Advantages:

-Improved accuracy in particle characterization

-Fine-graining via machine learning

-More accurate and consistent powder characterization

-Applicable to simpler single-camera systems

-Increases virtual optical resolution of fine-particle perimeters

Applications:

-Additive manufacturing

Technology ID

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Category

Robotics & Automation/Simulation, Digital Twins, & Industrial Automation
Materials Science & Nanotechnology/Composites & Hybrid Materials

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View online

-Metal powder production

-Quality control

TRL: 2

Intellectual Property:

Provisional-Patent, 2024-06-11, United States

Utility Patent, 2025-06-11, United States

Keywords: Particle shape analysis,Additive manufacturing quality,Powder bed fusion optimization,Porosity control in powders,High-resolution image analysis,Digital powder characterization,Machine learning in AM,Single-camera shape detection,Metal powder quality control,Advanced feedstock engineering