Powder Flow in Additive Manufacturing –
Challenges and Opportunities

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ABSTRACT

As the particle size distribution of metal powders used for additive manufacturing is decreased and widened, the quality of the manufactured parts increases. However, reliable handling of these finer powders becomes more challenging.

Fine powders are generally more cohesive and, when settled, can present discharge rates that are much lower than coarse powders. These differences in flow behaviors can preclude existing handling systems from being used with finer powders and result in more challenging designs for new systems.

In order to determine whether an existing handling system can be used with a new powder or designing a new handling system, the properties of the powder to be handled need to be measured under representative ambient (temperature, humidity) conditions.

This paper discusses the flow behaviors of powders in handling systems and the test methods used to determine the most critical flow properties. The flow properties of 316L stainless powder with different size distributions are used to evaluate the expected flow behavior from a typical mass flow holding hopper.

The finer powder, although exhibiting a higher unconfined yield strength, does not present a potential for arching in the hopper used for analysis. The difference in particle size distribution between the fine and coarse powder samples is approximately 1 μm at d_{50}. Even with this small difference, the maximum steady state discharge rate is approximately 63% lower for the fine powder sample than the coarse powder sample.