Characteristics and properties of iron powder with flow additives

Linus Lidman

Metal powders are used all around us, from sintered parts in the automotive industry to welding and brazing. With the rise of Additive Manufacturing (AM) understanding and manipulating the flow of iron powder becomes crucial. AM allows for higher complexity and larger design freedom but requires well flowing powder for good quality products.

Powder flowability is not as simple as one might think, there are many interactions and forces competing which makes the outcome sometimes poorly understood. It is known that nanoparticles in the form of fumed silica can help improve the flowability of some powders. However, the amount and type suited best for iron powders used in AM is not.

In this study it was found that a concentration of 100 parts per million (PPM) flow additive gave a flowability increase of up to 18% compared to powder without any additive. This increase could give rise to a higher productivity output, better quality of finished product and powders that previously could not be used in an AM machine may now be viable. The results of this study have already started to get implemented to poor flowing powders by one of the leading manufactures. This shows the great importance to tackle the problem of poor flowability.

The amount of flow additives was found to be impactful. At higher concentration of additive than 100 PPM the effect decreases quickly and at a concentration of 1000 PPM the flowability is almost 30% worse than a powder containing no additive at all. Therefore, it important to be careful during mixing so that a reversed effect is not achieved. The optimal amount needed probably differs from powder to powder depending on size of the particles and their shape. Which unfortunately makes it harder to directly apply to new powders.

The way the tiny flow additive particles are applied to the larger bulky powder particles was also one of the areas of interest for the study. It was found that a low intensity mixing was preferred over a high intensity. The main problem with high intensity mixing was that the base powder particles got reshaped by the violent mixing. Another problem was that the intensive mixing caused some of the flow additive to disappear, the reason for this is still unclear.

I hope my work will be used as guiding on how to mix flow additive with iron powder, what concentrations to use and which type is most effective. This can then hopefully lead to AM taking a leap in quality, versatility and productivity and truly be a contender as a manufacturing technique alongside the traditional methods.