Micro Metal Injection Moulding

Technical NEWSLETTER

Micro MIM Japan Holdings Inc.

Vol.19
micro mim japan

Evolution of additive manufacturing Vol. 1 (Metal AM outline)

The additive manufacturing (AM) technology has been actively developed in Japan since AM was promoted as a national project in 2016. We would like to introduce the AM trends from the perspective of metal injection moulding or MIM manufacturers.

Classification by powder supply and printing method

Supplying metal powder used in the metal 3D printer is roughly divided into 2 methods. One is supplying to the on-site printing part by a nozzle and the other one is spreading the powder over the existing layer by a roller in advance. The on-site nozzle supply type has higher material yield than stacking layer by roller type because the supplied powder is consumed almost 100%. However, it is required to compose enough quantities of columns to support the product structure during the process, thus, the total material yield becomes low in many cases. The stacking layer by roller method, it is required to spread equally on the whole processing area, thus, the material yield is low. However, the unused powder act as supporting columns during the process, therefore, it is possible to reduce the post-processing steps after printing. Additionally, a high percentage of unused powder is reused nowadays.

The printing method can be sorted into selective sintering (SS) and binder jetting. While the metal powder is the sintered during printing by SS, binder jetting requires debinding and sintering like MIM after printing. In binder jetting, the adhesive is printed on a required area to bond the metal powder to form a product structure. The heat source in SS has been studied intensively and the printing speed increased drastically in the last few years. In 2016, it is launched 50 cm^3/hour printing machine and it is targeted to achieve 250 cm^3/hour or even 1000 cm^3/hour as the next-generation machine. The binder jetting printing speed is higher than the SS. The printing speed of 60-100 cm^3/hour machine has already been in the market.

Metal powder used in metal AM

In the metal AM, the spherical powder is employed as well as MIM. There is a very limited problem in MIM manufacturing if the fine metal powders are mixed. However, in metal AM, the too-small particle leads to deterioration in printing quality. Therefore, both upper and lower size limit tends to be set for metal AM. Besides, since the reduction reaction during the SS sintering process cannot be expected, the metal powder produced by expensive gas atomization is applied most. Due to these limitations, the AM powder is even more expensive than MIM powder, which is the most expensive in the conventional powder metallurgy.

Hurdle of “30μm”

A metal 3D printer contains various latest technologies, such as employing powder with strictly limited particle size, multiple heat sources, and adopting a highly accurate system to control moving parts. The development of metal 3D printers in the last few years is remarkable, and it must have brought great benefits to other industries. However, there seems to be still a high hurdle for dimension control of ≤ 30 μm. The 3D printer has gained productivity to compete with other metal processing methods, though it is necessary to wait for a further breakthrough to achieve ≤ 30 μm tolerance requirements.

Our manufacturing division, Taisei Kogyo Co., Ltd., has μ-MIM® and 3D-MIM® that mass-produce complex shapes with an accuracy of ± 10 μm if a part is ≤ 5 mm. We continually contribute to the development of metal 3D printer technology with the debinding and sintering Know-How that we have cultivated through MIM manufacturing.

Column

I am Hikoji Okuyama, in charge of Research & Development in Japan. I have joined the company in March 2019 so I am relatively new. Although I am not young anymore, I find every day something new in the metal world, which requires deep knowledge. I believe this will keep my brain sharp! On the weekends, I play tennis and go cycling. In winter, I also enjoy skiing. Another thing I enjoy is travelling – I went to the Scandinavian and Baltic countries with my son last year in the wintertime. That was really cold!