

## 1. Features of 3D printer and MIM the designers ought to know

There are various methods for manufacturing small metal parts. 3D printers, which have been developed significantly in recent years, can produce small, complicated design metal components. This time, the difference of metal 3D printer and MIM is introduced.

### • Variations of materials

The number of applicable metal powders for metal 3D printer is fast increasing. In common metal 3D printer, managing steel, stainless steel, cobalt chrome, titanium and copper are applied.

For MIM, in addition to these metals, precious metals or magnetic metals application development is in progress.

### • Accuracy and density

The accuracy of common MIM is approximately 2/100 - 3/100 in every directions (accuracy of μ-MIM® in Taisei Kogyo is approximately 1/100). This accuracy level is difficult to achieve in common 3D printers. Also, mechanical properties such as tensile strength are different in vertical and horizontal directions since 3D printers form the shape by stacking metal powder layers. The almost same density of 99% can be realised in both 3D printers and MIM.

### • Lot size

MIM is often employed when more than 300 pieces lot size production since it requires a mould. On the other hand, 3D printers are suitable for the small lot production because the components are produced without using mould. However it is said 100 pieces is the maximum lot size for 3D printers since the manufacturing requires 2 - 6 hours per piece.

It is important to choose the appropriate processing method such as 3D printers for less than 100 pieces and MIM for mass production.

## 2. MIM application to processing resistance material components

Mass production of tungsten alloy has been realized

### • Tungsten alloys

Downsizing and thin thickness are the essential technical themes for small information terminals or smartphone, to improve the products performance.

Parts manufacturers are developing using the new materials and technologies in order to achieve the requirements. We have also studied to bring the technical innovation to this small electronic components industry using our μ-MIM® technology. This time, we would like to introduce our tungsten alloy MIM technology development.



▲ MIM specimen of tungsten alloy

If the parts are smaller, the required strength and accuracy are becoming higher. It is also likely to increase the processing cost due to the difficulty of processing itself or inspection procedure.

For example, for information terminals components, high specific gravity metal is adopted in order to reduce the size without changing the required weight.

In general, workability of metals with high specific gravity is poor. Especially tungsten alloy, the processing costs for machining of small components would be extremely high.

Thus, we can say there are advantages of using MIM for manufacturing tungsten alloy small components, however there are also some particular problems of tungsten alloy in MIM manufacturing.

First is the segregation of metal powder. Tungsten alloy powder has high specific gravity so it requires a good control that the metal powder does not segregate during the feedstock manufacturing and injection moulding. Second is sintering. Since the melting point of tungsten alloy is high and it takes long time to reach the sintering temperature, if the time after the degreasing is longer, the possibility of deformation will be higher. We have solved these issues and realised the tungsten alloy MIM mass production. In this example, it was confirmed that the processing cost is reduced to one third to one fifth of machining.

### Taisei Column



My name is Sakai. I am in charge of improving internal system as well as in the production department. I rarely have opportunity to talk face-to-face with customers. However, I feel it is important tasks. On my days off, I like to travel, so when I have a long weekend I go to Hokuriku or Tohoku region, visiting beautiful sights as well as enjoying local food. The other day I went to Kanazawa, which was fantastic. It is highly recommended to visit as both Sake and seafood was fantastic!