

Problem solutions in MIM process; Injection moulding process

In the metal injection moulding (MIM) process, every processing parameter will affect the final component's quality significantly, especially in small and complicated designed MIM components production. This time we would like to introduce some common defects and their solution in the injection moulding step.

Injection problem solution in mould design

One of the USPs of MIM is near-/ net shape serial production. Therefore, MIM manufacturers are always trying their best to minimise the post-machining. Additionally, the small components, which we μ -MIM® deal with, are difficult to hold or chuck in the machining process. Thus, it is necessary to eliminate the post-machining section. Generally, the injection moulding process is the only step that forms the component; therefore, the mould design is important to eliminate or minimise the possibility of post-machining. The gate design will affect the component quality most in the injection moulding step. The largest shear stress change on feedstock occurs at the gate, e.g., the highest share stress is observed at the gate and the lowest share stress is observed just after passing the gate area. This shear stress change leads to metal powder and binder separation and eventually, a poor surface finish, deformation, inhomogeneous density in part could be observed. The solution to this problem is locating the large cross section area gate at the thickest section in a component. However, most customers are not happy to have a large gate mark and they might request the post treatment for the large ugly gate mark. Therefore, enlarging the gate size is not applicable from the point of appearance issue, and moreover, the large gate suppresses productivity since the gate cut, removing the part from the runner, will be difficult.

Problem solution in moulding parameter

The airflow design in the mould is also important for stable injection moulding. The injection moulding process is normally held at atmospheric pressure. Thus, when the feedstock arrives at the cavity, there is some air remaining. The remaining air should be pushed out from the cavity without increasing feedstock pressure when the mould is completely closed. Unfortunately, the airflow and the flash creation is a trade-off relationship. The injection parameter optimisation is also useful for stable serial production. The ideal small gate size with minimal clearance mould is expected injection difficulties, however, lower injection speed can minimise the share stress change, good airflow without creating flash. On the other hand, low injection speed lead weld lines or flow marks due to the low viscosity of the feedstock. When the injection speed is low, the time of flowing the feedstock in the cavity becomes long and the feedstock temperature is dropped. The low temperature feedstock has a high viscosity and the weld line or flow mark, which is not only leading to the appearance issue but also mechanical property problem, will be observed

Feedstock development enlarges the injection processing window

As shown previously, balancing parameters are an important technique to realise stable serial production. Since we have experienced the injection moulding process for more than 50 years including the plastic injection moulding era, we are confident in the injection parameter optimisations. However, even investing our plastic injection moulding experience, the MIM injection moulding is difficult, and the small complicated MIM components moulding is even worse. The reason μ -MIM® has been realising the serial productions of small complicated design components is that we kept developing the feedstock too. We are able to specify the problem points that we cannot eliminate from the injection moulding parameter optimisation and reflect the problem points to the feedstock development. Our μ -MIM® technology will defy your MIM understanding.

Column

The area where our European office is located is called Ortenau region in the state of Baden-Württemberg, in southwest of Germany. It is well known as wine growing region. There is a route called Baden Wine Route which goes for about 200km! In autumn, there is a wine festival and wine hiking in different towns, including Offenburg where our office is located. Unfortunately, due to the COVID pandemic, we have not had the wine festival in 2020 and 2021 but hopefully next year you can come and visit us during this period. Now the wine field is in golden color, which is absolutely amazing!