

Q7: When is the Sticking issue finished and how many solutions do you know?

A7: The 4 major directions to overcome the phenomenon of Sticking.

In the last issue of "DITSA News", we learned about the causes of casting sticking, including 4 main factors including metal interface reaction, mold design, influence of mold release agent, equipment, and process parameters; this issue is to bring 4 main solutions to provide readers with a reference direction to reduce the occurrence of sticking phenomenon.

- **Reasonably reduce mold temperature**

From the analysis of the interface reaction of the metal, it can be observed that "the higher temperature, the stronger the affinity between the molten aluminum and the mold, and the more obvious the sticking phenomenon"; reasonable inference, "lowering the mold temperature" has become an obvious solution.

For the cylinder mold of a certain factory, the temperature of the mold opening test made by the infrared thermometer found that the thicker mold wall and the relatively poor water-cooling effect resulted in a higher temperature, and the corresponding degree of mold sticking phenomenon was also more serious; In addition, by adjusting the spraying position and time, the sticking phenomenon can be reduced.

In addition, under the premise that the process parameters remain unchanged, the water valve corresponding to the position of the easy-to-stick mold position near the gate is tested in three states: closed, half-open, and fully opened. After the mold is normally produced, the temperature will soon reach 200°C or more, so do not need to worry mold temperature too low leads to release agent coating performance. It has been proved through experiments that lowering the mold temperature can indeed reduce the interface reaction and improve the adhesion of the release agent.

- **Adjustment of release agent and spraying method**

The release agent produces a membrane with spreadability, lubricity and high temperature resistance between the molten metal and the mold. This membrane directly determines the degree of adhesion of the casting; therefore, it is very important to choose a release agent with stable ingredients and good quality. A better demolding effect is obtained, and a protective layer can also be formed on the mold. After long-term production, the surface of the mold can be impregnated to reduce the corrosion of the molten metal.

On the other hand, in order to improve the production cycle, some die-casting factories spray after the mold is opened and the parts are taken. At this time, the

mold temperature is above 350 °C. When the heat transfer surface temperature exceeds the Leidenfrost temperature (in the droplet boiling curve, the minimum heat flux is corresponding wall temperature), solid and liquid cannot directly contact to form a vapor membrane, the heat transfer coefficient is greatly reduced. This is not conducive to the spread of the release agent, and actually causes a waste of usage. The effective ingredients of the release agent should be coated on the surface of the mold when the mold temperature drops to 200-250°C.

In addition, too much or excessive spraying methods cannot effectively coat the mold release agent on the surface of the mold but will cause the unattached components in the front to be washed away by the subsequent spray; let the mold release agent have sufficient time to adhere to the mold surface, It is best to spray back and forth by atomization, which can reduce the phenomenon of strain and sticking of die castings.

- **Conditionally reduce high speed and casting pressure**

In the face of increasing market competition, parts manufacturers are constantly pursuing castings that can achieve smooth surfaces and good internal quality; among them, many die-casting factories choose to use high-speed and high-pressure conditions to achieve their goals, especially when shrinkage and hole appear. However, the reasons for the formation of defects such as shrinkage holes and holes in castings are not the same, and it is not necessary to rely on increasing pressure or speed to solve them. Blindly increasing the pressure will not only increase the chance of sticking the mold, but also reduce the life of the mold and equipment, it will not be worth the loss.

When shrinkage hole defects are found, the cause should be found first, and check whether the casting pressure is insufficient, whether the nitrogen cylinder pressure gauge is suitable, whether the aluminum liquid spectrum and density equivalent are within the required range, etc., without affecting the quality requirements, make appropriate adjustments to avoid backfire.

- **Mold maintenance**

For molds that have been nitrided, the polishing should be careful to prevent damage to the nitride layer on the surface and avoid the situation that the more polished the mold becomes; for the impact part or core of the inner runner, a tungsten carbide rod coating machine can be used to the electric spark metallurgy method is sprayed with tungsten carbide microparticle layer on the surface of the mold. After these particles are combined with the base metal, they will not fall off, which can improve the anti-sticking property of the mold surface. When a 2~4 μ m

thick coating is deposited in the surface layer of the die-casting mold, its hardness can reach HV4000~4500, and the use temperature can reach 800°C .

Sticking has a great impact on production and quality, but as long as you can pay more attention to the rationality of the runner design, and under the premise of ensuring quality, use lower mold temperature, lower aluminum temperature, lower high speed, lower high pressure conditions as much as possible For production; if there is a partial sticking that needs to be polished, it must be handled carefully to prevent damage to the nitride layer of the mold; in addition, choosing a good-performance release agent and appropriately adjusting the spraying method are all solutions to help us solve or even avoid the sticking phenomenon.

This article is excerpted by Cao Jinwei, a graduate student of the Department of Mechanical Engineering, National Taiwan Ocean University, and is extracted from: Methods and Measures for Improving Die Casting Surface Adhesion Defects, Gao Zhengyu, from Global Casting Magazine.