



Molding Tips for Improved Appearance and Performance of Plated Pieces

Over 90% of plastic plated applications are decorative, so the appearance of the plastic is crucial to the plated piece. ABS resin is far and away the most commonly plated plastic. It's inexpensive, relatively easy to injection mold or vacuum form, and probably the simplest material to electroplate by modern mass production techniques.

ABS resin is not a single polymeric material, but consists of three distinct polymers: polyacrylonitrile, polybutadiene and polystyrene. It is quite easy to electroplate compression molded or extruded sheet ABS to give good adhesion, but the vast majority of plated ABS components are injection molded, and plating adhesion can be affected by a number of factors.

The design of the component itself and many elements involved in the injection molding process can significantly impact the success you'll have in plating the ABS component.

Molding Tool Design

In combination with the proper molding techniques, the design of the component itself has a considerable influence on the degree of success in plating. The following design features should be incorporated wherever possible:

1. Sharp corners and indentations should be rounded off.
2. Gates should be 50% larger than for conventional ABS moldings, and more of them should be employed (less than 25 cm apart)
3. Minimum wall thickness 1.5-1.6 mm for successful adhesion
4. Avoid rapid changes in section thickness (3mm 4mm average)
5. Avoid blind holes as they will give excessive solution carryover but, if necessary, the depth of the hole should not exceed 50% of the width.
6. Wherever possible, from the appearance point of view, break up a large, flat surface with a pattern of some kind.
7. The surface of the molding tool itself must be highly polished to impart a good surface finish to the component. Under no circumstances should silicone type mold release agents be used, as these will be retained on the plastic surface, giving incomplete metal coverage or poor adhesion in later stages.

Having obtained a satisfactory tool, it's also important to use the tool on the right size and type of injection molding machine. If the molding machine is too large, sensitive control over important operating parameters cannot be maintained.

Likewise, if the machine barrel capacity is too large for the tool cavity being used, the ABS spends too long in the barrel of the molding machine in the molten state at high temperature. This can cause degradation of the ABS, obviously giving poor results on plating. Ideally, the ratio of barrel capacity to shot weight should not exceed 3:1.

The Proper Injection Molding Process

Dry time:

ABS resin readily absorbs water from the atmosphere. Stock should be dried at 80-85 degrees C for two hours immediately before molding. If this isn't done, small blisters will appear on the plastic surface after molding. Called "water blisters," they will get dramatically bigger during the plating process.

Reducing stresses:

Many aspects of the molding process must be carefully conducted for success plating. It is essential that a component is produced having a uniform distribution of the desired spherically shaped butadiene globules over the whole surface of the piece. At the same time, the tensile and compressive stresses induced in the S.A.N. (styrene-acrylonitrile) copolymer matrix during the mixing and injection stages must be kept to a minimum.

Incorrect molding techniques will give non-uniform surfaces having a high degree of molded-in stress. These stressed areas can cause poor or no coverage; at least 50% of all problems associated with the plating of ABS can be attributed to either design or operational molding faults.

It has been found that the screw feed injection molding machines give the best results from both adhesion and coverage points of view. The screw action gives uniform mixing and heating of the resin prior to injection and, when operated correctly, will give low stress, uniform moldings.

Hydraulic ram type machines which rely entirely on external heating of the resin and do not possess the excellent mixing characteristics of the screw type machines tend to give poor, highly stressed moldings.

Recommended Fill Rates

Long fill times are essential to give uniform, low stressed surfaces. For example, small components (up to 90 grams in weight) should take between 5-7 seconds. For larger components, fill rates can be up to 25 seconds.

Recommended Stock Temperature:

The stock temperature during injection has a profound effect on the plateability and adhesion characteristics of the component. High melt temperatures giving low viscosity and less shearing action during injection lead to lower stresses and good adhesion. Recommended stock temperature: 245 – 270 degrees C.

Recommended Mold Temperature:

Mold temperatures have only a secondary effect on the adhesion figures obtained after plating, but a cold mold will produce components with a dull surface and higher internal and surface stresses. Mold temperatures should be 65 – 80 degrees C.

Injection pressure isn't too critical, but excessively high pressures produce internal stresses in components, leading to distortion during the chemical processing stages. Secondary "back-up" pressure should not be so high that it forces more material into the cavity during cooling, as this will induce further stress.

Internal stress can be reduced by slow cooling of the component after injection (for example, about 30 seconds) or by stress relieving at 80 degrees C for two hours before plating.

It's obvious that the combination of slow fill rates, high melt temperatures and slow cooling will give much longer cycle times than are normal for molding non-plating grades of ABS. Consequently, the output from any one molding machine is lower. However, to achieve good results in the plating stages, it is essential that the recommended conditions are closely followed.

Testing ABS Moldings

No foolproof method exists at present for testing ABS moldings to assure that they will plate successfully, but a simple test does exist which gives a good indication of subsequent plating performance.

The test consists of immersing the molding in glacial acetic acid for two to three minutes, rinsing well in cold water and then allowing it to dry without wiping. Areas of high surface stress which will tend to give plating problems show up as white areas with very fine micro-cracks. Components with high internal stress will show deep cracks into the body of the plastic.