Avoid disruptions in the metal stamping process through effective demagnetization

Stamping processes are used in mass production. One of the main objectives is low-cost production, which is why the stamping processes must run as quickly as possible and reliably. Under these circumstances, malfunctions in the stamping process or even tool breakage are worst-case scenarios that one wants to avoid at all costs.

Increased residual magnetism in punching tools and especially in scrap/waste holes leads to magnetic adhesion of ferromagnetic punching residues. These punching residues tend to clog the scrap holes and, in the worst case, lead to tool breakage. Other known interference effects due to residual magnetism are imprinting of punching residues in components or displacement of production parts from the punching position due to magnetic forces. The processing of thin sheets with high magnetic permeability (stamping of motor core lamination) additionally increases the interference caused by magnetism. The reason is that these thin sheets already adhere magnetically at low residual magnetism. This applies in particular to the fine blanking of electrical sheet metal.

Stamping dies are made of high-strength steels. In addition to hardened steel materials, carbides are often used, especially for dies and punches. The tools are mainly manufactured by processes such as machining, drilling, grinding, and EDM. Furthermore, the clamping of the parts during these manufacturing steps is frequently carried out by magnetic clamping devices. Depending on the application and requirements, surfaces of tools are additionally coated. Typical processes here are PVD/CVD coating or electroplating. The assembly of the usually complex stamping tools is carried out manually by skilled personnel. Hand tools, measuring equipment and other utensils are used during assembly.

How can the tool components be magnetized in the above processes?

Machining, drilling: Direct contact between cutting insert or drill and production part. This means that residual magnetism can potentially be transferred via the contact surface.

Grinding: The risk of magnetization of the parts directly through the grinding process is rather low. During grinding the parts are often held in place with magnetic clamping devices (magnetic chucks). Due to the direct contact between the component and the magnetic chuck, a relatively high residual magnetism usually remains in the material. This is the case even if the magnetic chuck has an integrated demagnetizing function.

EDM: During erosion, strong pulsed currents flow between the electrode and the component. This current flow in turn generates its own magnetic field for physical reasons, which magnetizes the eroded areas in the material.

Coating: For galvanic coatings, such as chrome plating, strong direct currents are necessary for the process. These direct currents flow at least partially through the components to be coated and can magnetize them.

Mounting of stamping tools: Direct contact between magnetized tools (for example screwdriver tip) and the stamping tool surface leads to the transfer of residual magnetism. Aids such as magnetic dial gauge stands leave strong magnetic imprints in the tool surfaces.

How is residual magnetism detected in toolmaking, what is state of the art today?

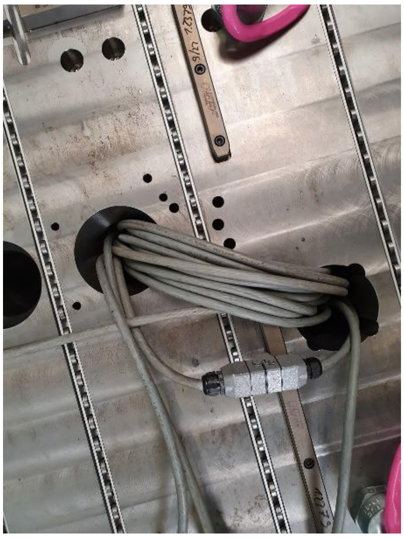
Experience from the field shows that residual magnetism measuring devices (Teslameter, Gaussmeter) are rather rarely used in toolmaking. Without these measuring devices, paper clips or individual punching scrap are used to determine any magnetic adhesion to the tool. As an example, a paper clip will not adhere until there is a residual magnetism of between about 20-30 Gauss. However, very fine punching residues from high permeability sheet metal can adhere at 10 Gauss or less. In many cases, the residual magnetism can only be determined by chance without a measuring device, also because other effects may cause an adhesion effect (e.g. adhesion due to oil film). The detection of residual magnetism without a measuring device is particularly difficult in deep scrap holes with small diameters. Suitable residual magnetism measuring devices in the field of toolmaking are transverse Hall probe measuring devices with fine, thin measuring tips, so that accurate measurements can be taken in holes, outlines and gaps.

Which devices are used for demagnetizing, what is state of the art here?

In most cases, simple demagnetizing devices such as plate demagnetizers or hand demagnetizers are available in the toolmaking departments. These can be used to effectively demagnetize small parts with wall thicknesses of up to approx. 10mm. However, larger parts with material thickness significantly greater than 20mm or very hard tools steels (carbides) can no longer be effectively demagnetized with these devices. Contours, bores and scrap holes of larger tool plates with material thickness of several centimeters can no longer be effectively demagnetized with plate or hand demagnetizers for technical reasons. The effective fluxing depth in the material is simply too small with these devices. It is not uncommon for incorrect operation of these devices to actually magnetize the parts rather than reduce the magnetism. This happens especially when the switch-on button is turned off too early and the device is still on the component or in the vicinity. Most of the time, people are certainly not aware of the limited depth effect of these devices and the resulting consequences.

Solutions for effective demagnetization of complex tools

The demagnetization of large tool plates works efficiently by using a precisely controlled alternating field with high field strength, very low frequency and a field volume enveloping the plate. For this purpose, the tool plates are manually wrapped with special magnetic field cables and automatically demagnetized with one or more low-frequency alternating field sequences. Larger openings in the tool plates can be effectively used with the magnetic field cables to demagnetize partial areas with the greatest possible effect (waste/scrap holes, etc.). The flexibility of the magnetic field cables allows the plates to be wrapped in different directions, resulting in multiple flow directions for each demagnetization. This very significantly increases the effect of demagnetization.



With additional strong pulse coils for demagnetization, tool surfaces can also be demagnetized directly in the presses without having to remove them. Medium and small components can be demagnetized particularly effectively with tunnel coils of the SSM series.

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