



Impact of Electrical Discharge Machining on SilcoTek's Coating Process

Technical Insight

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Synopsis

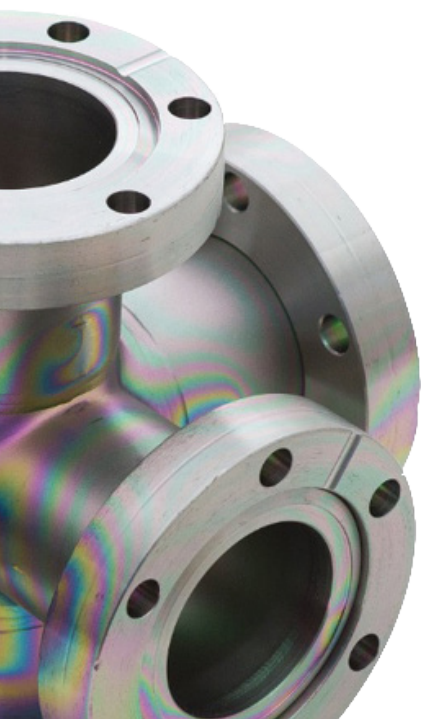
Wire electrical discharge machining (EDM) is a technique that can be used to make very high tolerance parts. Recently parts were unknowingly fabricated via EDM and sent to SilcoTek for coating. These parts failed our coating process. This TI will discuss details of why certain EDM processes are incompatible with our coating technology.

Background

SilcoTek typically does not have the details about processes parts see prior to arrival for coating. There are often steps that are unknowingly detrimental to the coating process. Some examples are cleaning with incompatible detergents such as simple green or other common household detergents, cross contamination of copper alloys whether it be by machining with the same tool or contamination via cleaning in the same bath, or in the case of this TI, utilizing wire EDM instruments for machining parts. In particular, the use of brass or copper wires while performing EDM can cause issues.

Data and Discussion

Copper and alloys that contain large amounts of copper are known to not coat well through our process. The copper can catalyze silicon nanowire growth rather than the desirable planar growth expected from our coatings. For this reason, many copper based alloys are marked as “not treatable” on [SilcoTek's material compatibility guide](#). There are times that customers inadvertently perform steps that incorporate copper into their parts making typically treatable parts no longer treatable. For example, a [previous investigation](#) found copper contamination from a machine shop that would machine brass and stainless steel parts on the same instrument without changing tooling would cause such issues.



Electrical discharge machining (EDM) is a technique that can be used to machine parts to very tight tolerances. For a description of this technique, [please watch this youtube video](#). Figure 1 shows coupons that were machined via EDM on one side of the coupon. Not only do the two sides look different visually, but the XRF instrument our receiving team uses to inspect incoming product detected an elemental difference.

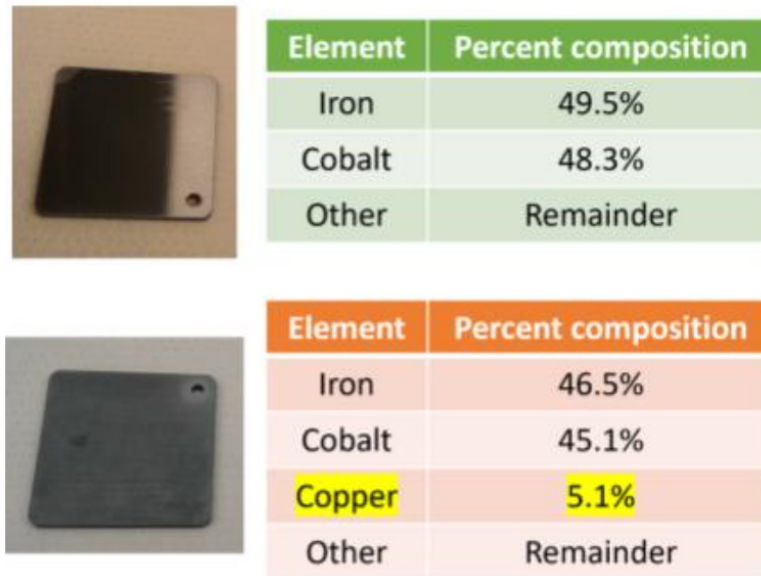


Figure 1: Metal coupon that had a different appearance and metal composition on each side. The top shows a surface that was not cut via EDM where the bottom shows a surface that was made via EDM.

During the EDM process, small amounts of the cutting wire, which are typically made of copper or brass will embed themselves into the metal surface. Previous experiments show that even nitric acid treatments do not fully eliminate the copper contamination, and the result will be a poor coating appearance through our process.

Conclusion

As brass is the most common EDM wire material in use today, EDM can cause copper contamination into the substrate that is near impossible to remove using cleaning techniques at SilcoTek. The copper contamination can lead to silicon nanowire or other detrimental growth modes causing the coating to appear dirty and unacceptable. SilcoTek recommends that customers do not use EDM to machine their parts. If utilizing EDM is unavoidable, it is recommended that molybdenum or tungsten wire, which do not show deleterious effects, are used rather than copper or brass wires.



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