

ODU TECHNICAL ARTICLE 04 | 2026

COST-EFFECTIVE USE OF SILVER

IN CHARGING CONTACTS FOR eMOBILITY



INTRODUCTION

Over the past two decades, eMobility has reached market maturity and become widely adopted. As a result, the demand for charging infrastructure and standardized high-current charging interfaces has also increased. Conductive charging — a pluggable connection consisting of a contact pin and a socket — has become the standard. Industrial power contacts made of copper and copper alloys with an electroplated silver coating served as a model.

Electroplated coatings play a particularly important role in the field of contacting. The choice of coating and its composition — which can form complex coating systems — significantly determines the features of the contact. The coating alters the tribological features of a connector system, making it more resistant to various environmental influences when

used in appropriate applications, or improving its electrical transmission features, to name just a few. Despite their seemingly thin coatings, which are only a few micrometers thick, these coatings significantly impact the function of an electrical contact.

Silver has become the preferred coating for high-current contacts. With a conductivity of about 62 MS/m, silver actually exceeds that of pure copper, which has a conductivity of only about 58 MS/m.

LOW-LOSS POWER TRANSMISSIONS



Fig 1. ODU TURNTAC®: Turned socket contacts for all common charging standards

Low-loss power transmission is a key consideration, especially in high-current connections. Heat loss at the contact interface is therefore undesirable.

However, since it cannot be completely avoided, it is important to reduce it as much as possible in order to prevent harmful effects on the overall system. Furthermore, energy losses always translate into financial losses. In this regard, the choice should always be the material with the highest conductivity.

Since silver is much rarer than copper and therefore more expensive, it is used only as an electroplated coating.

SILVER PRICE DEVELOPMENTS

Charging interfaces for NEVs (New Energy Vehicles) have long since been standardized. However, it was only through field testing under real-world conditions that it became clear just how much stress charging contacts actually have to withstand. For some products on the market, durability and resistance to wear and tear during the product's life-time are a real challenge.

Standards for charging interfaces now consistently require a minimum layer thickness of 5 μm of silver or a silver alloy in the contact area. So far, this has not posed a significant

problem. Until now, little attention has been paid to silver in pricing. With the exception of two major outliers in the late 1970s and early 2010s, the precious metal has been a solid and predictable asset.

Last year, however, saw some dramatic price movements, with silver reaching an all-time high. Silver can no longer play a minor role in the overall cost analysis; rather, it plays a dominant role. The reasons behind this rapid price movement are as varied as the future growth potential of silver. The least likely scenario is that the price of silver will return to its original level and remain largely stable.

ESCAPING THE DILEMMA

However, completely abandoning silver and silver alloys at this point would be the wrong approach. After all, the advantages of electrical plug-in contacts remain. Rather, the goal is to use the precious metal in a more targeted manner and, where possible, in a way that conserves resources. One option is the selective use of silver, as is common practice with stamped contacts on a strip. Only the area relevant to the function is coated with silver. With stamped contacts, the advantage isn't just that it's easy to reduce the amount of precious metal used. Automated processing on the assembly line also makes such products particularly attractive. However, the selection of available providers in the charging station area is limited.

More commonly used are turned and molded contact pins and sockets. Selective coating is largely uncommon in this field. Frame processes that involve additional masking are costly.

There are other approaches with significantly lower throughput than a conventional bulk material process. Production costs are consequently much higher here as well. In the end, the benefit of saving money is lost.

The solution to this dilemma lies in the charging standards themselves. On the one hand, there is a requirement for the contact area to have a minimum coating thickness of 5 μm of silver or a silver alloy; however, alternatives are also permitted. Other coatings may be used if two additional tests have been passed. The contact system is subjected to mechanical loads in the form of mating cycles on multiple occasions.

The study will then examine how increased humidity affects transmission patterns. In the second inspection, the connector assembly is subjected to thermal cycling to identify any signs of aging. If both additional tests are passed, there would be no obstacle to using a coating with a deviation in coating thickness. Were it not for the general requirements regarding mating cycle endurance and the issue described above—namely, that not every contact manufacturer has properly balanced the contact system.

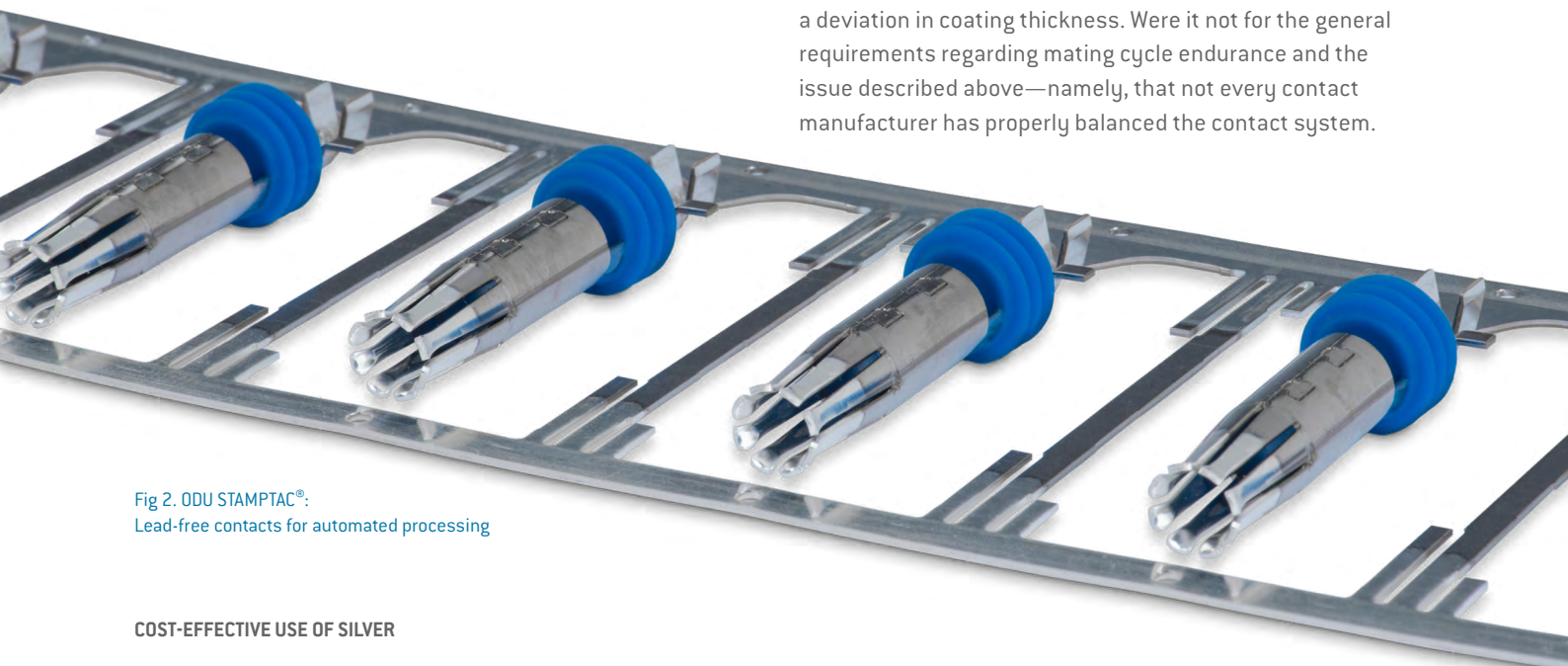


Fig 2. ODU STAMPTAC®:
Lead-free contacts for automated processing

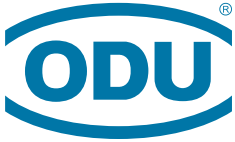
YOUR ODU CONTACT SOLUTIONS



The **ODU STAMPTAC**[®] stamped contact, which can be processed fully automatically, features selective plating in the contact area combined with a reduced silver layer thickness while maintaining full functionality. The low use of raw materials and the absence of lead also make this type of socket contact particularly attractive.



The **ODU TURNTAC**[®] contact system offers greater flexibility in applications. It consists of a twisted socket contact paired with a contact pin. You can choose between a version with a silver coating of at least 5 μm , in accordance with the standard requirement, and another version with a significantly thinner—and therefore more cost-effective—coating thickness. Both versions are perfectly balanced and, with 20,000 mating cycles, already exceed the standard industry norm by a factor of two.



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COMPANY PROFILE ODU

The ODU Group is one of the world's leading suppliers of connector systems, employing 2,800 people around the world. In addition to its company headquarters in Muehldorf a. Inn (Germany), ODU also has an international distribution network, production and product development sites in Sibiu / Romania, Shanghai / China, Tijuana / Mexico and Camarillo / USA.

ODU combines all relevant areas of expertise and key technologies including design and development, machine tooling and special machine construction, injection, stamping, turning, surface technology, assembly and cable assembly.

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ODU Connectors ensure a reliable transmission of power, signals, data and media for a variety of demanding applications including medical technology, military and security, automotive, industrial electronics, and test and measurement.

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