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Partly Automated Plant

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Silver Graphite Coating for High Current Applications

A new silver-graphite dispersion electrolyte has been developed specifically for coating connector contacts in high-current applications. Here, the deposited layers are intended to ensure maximum charging performance over the entire service life of the charging connectors.

Umicore MDS has developed a silver-graphite dispersion electrolyte specifically for coating connector contacts in high-power applications – such as high-power charging (HPC). According to the manufacturer, the silver dispersion coatings deposited with the Arguna C-100 electrolyte are said to prove extremely stable even at elevated temperatures, enabling maximum charging performance at all times throughout the life of the charging connectors. This meets the industry's increased requirements for reliability and longevity for connector contacts.

Technical requirements not yet met

The longevity of previous connector contacts for transferring high charging power from the power source to the application or battery are not yet satisfactory for manufacturers or suppliers. Coatings with fine silver are state of the art in terms of electrical and thermal conductivity. The tendency to cold weld, combined with low hardness and a high coefficient of friction, leads to rapid wear of the silver coatings when mated frequently. In order to achieve the required mating cycles and to minimize wear, additional contact lubricants are therefore used on the silver surfaces. Due to the accumulation of dirt and dust particles, corrosive or abrasive foreign layers can form here over time, which can lead to an increase in temperature and a reduction in charging performance.
Hard silver coatings (silver alloys) have a significantly higher hardness and show noticeably improved vibration resistance in some applications. However, added metals have a detrimental effect on electrical conductivity and the coefficient of friction is usually close to the fine silver level.
The desire for durable and high-performance silver coatings for such high-current applications is obvious. Particularly in the field of electromobility, a shortened service life of charging plugs can not only cause costs due to material, time and service expenses – the image also suffers. If a permanently installed vehicle inlet of an electric car has to be replaced at an early stage and at great expense, or if the charging performance of the charging infrastructure continuously decreases, the reliability and quality of the supplier is called into question.

High abrasion resistance with maximum loading performance

According to the manufacturer, Arguna C-100 achieves exceptional abrasion resistance due to embedded graphite particles in the silver layer and thus the high reliability and longevity of the contact coating and charging plug desired by the industry. This is made possible by an optimized graphite component, which is embedded in the silver matrix and acts

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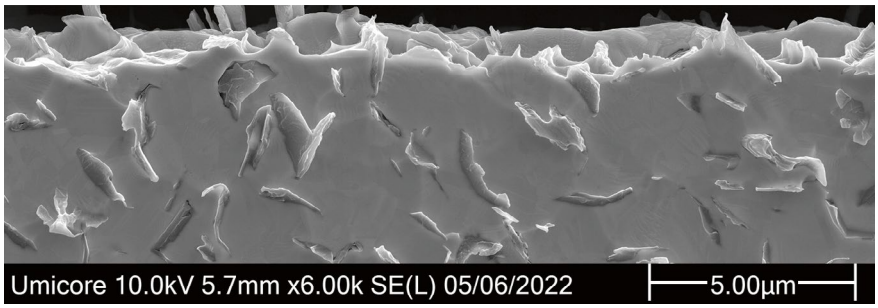
Contact socket and contact pin for EV charging plug coated with the silver-graphite dispersion electrolyte.



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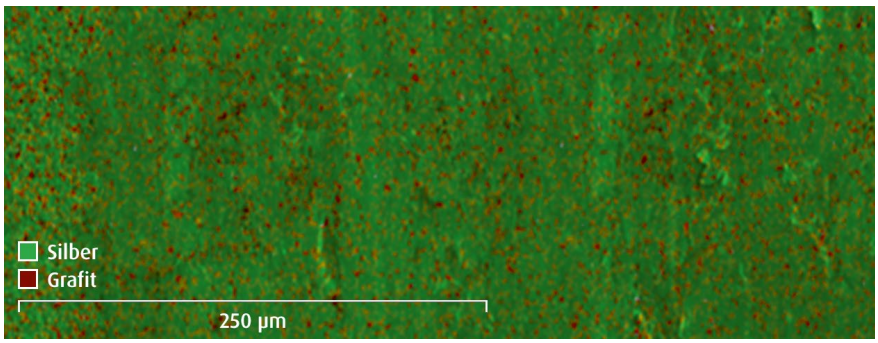
The scanning electron microscope shows the statistically random distribution and incorporation of the graphite lamellae in the electrodeposited silver matrix. The silver matrix was selectively etched back here and the incorporated graphite lamellae remain in their position.



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A view by element scan (EDX X-ray spectroscopy) of the contact surface shows the uniform and fine distribution of the graphite.

as a solid lubricant. With each friction process, a new surface is created and the abraded tips of the graphite lamellae are distributed over the friction surface. The usual abrasion of the silver surface is prevented, the contact resistances are kept small and thus a continuously high charging performance is ensured.

"Under laboratory conditions, an end-of-life tribometer test proves the low and stable coefficient of friction of the Arguna C-100 coating system. Even after more than 50,000 mating cycles, an intact silver graphite layer can be detected," explains Friedrich Talgner, Division Manager Technical Applications at Umicore. "Cross-compatibility with other mating contact materials – for example, fine, hard or dispersion silver coatings – completes the required functionality in the field."
The coating system thus combines and extends the positive properties of fine and hard silver. On the one hand, the fine silver matrix has excellent electrical conductivity; on the other hand, the maintenance-free solid lubrication of the graphite simultaneously increases abrasion resistance and thus reduces wear even with a high number of mating cycles. //

Contact

Umicore Galvanotechnik GmbH
Schwäbisch Gmünd (Germany)
Friedrich Talgner, Division Manager Technical Applications; Electroplating Business Unit
friedrich.talgner@eu.umicore.com
mds.umicore.com