

Electrochemical silver-diamond coatings

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Main demerits of silver electrochemical coatings are low wear-resistance and high porosity.

The use of detonation nanodiamonds (DND) at deposition of silver coating from toxic cyanic electrolyte has been known [1]. In work [2] possibility of deposition of silver coating from ferricyanic and dicyanargentate electrolytes in the presence of DND has been described. At that, microhardness increased by 20-80% and wear-resistance had a 1.5-2.0-fold increase.

The present work is devoted to investigation of an influence of diamond-containing additives such as: DND modified with ammonia treatment at 230°C, initial diamond-containing blend (DB) and partly oxidized DB [3] on quality of the silver coatings obtained from low-toxic dicyanargentate- thiocyanate electrolyte with the following composition, g/l: Ag (calculating on a metal) – 25, K₂CO₃ – 25-30, KCNS – 150. Temperature – 20°C, current density – from 0.5 to 0.9 A/dm², pH=10-11.

Kinetic studies showed that insertion of the additives into the electrolyte does not change known mechanism of deposition of silver, cathode process rate is limited by diffusion. The use of additives increases both electrolyte electroconductivity and throwing power. Specific electrical resistance of coatings does not practically increase.

In the presence of nanodiamond additives microhardness increases by 30-40% as compared with pure silver coatings (from 80 to 115 kg/mm²). As well microhardness rises as the current density is increased from 0.5 to 0.9 A/dm². Nanodiamond additives appreciably decrease porosity of silver coatings (from 65 to 2-5 pores/cm²). At addition of 1 g/l DND or 1.5 g/l oxidized DB into electrolyte the porosity reduction is observed to be maximum (to 2 pores/cm² at current density of 0.9 A/dm²). Wear-resistance of silver-diamond coatings increases ~5 times at 1 g/l DND or 1.5 g/l oxidized DB.

- [1] USSR Inventor's Certificate No 1668490, C 25D 3/46, prior. 10.05.1989, *Bull.of Inventions*, **29**, 123 (1991)
- [2] Patent application of Russia No 96104061, C 25D 3/46, prior. 16.03.1995, *Bull.of Inventions*, **12**(1), 67 (1998)
- [3] Patent of Russia No 2046094, prior. 26.07.1995, *Bull.of Inventions*, **29**, c.189 (1995)