

Corrosion Characteristics and Electrochemical Treatment of Heritage Silver Alloys

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Abstract : This study investigated the corrosion of a group of heritage silver-copper alloy coins and their conservation treatment by potentiostatic methods. The corrosion products of the coins were characterized by a combination of scanning electron microscopy/ energy-dispersive X-ray spectroscopy (SEM/EDX) and X-ray diffraction (XRD) analyses. Cathodic polarization curves, measured by linear sweep voltammetry (LSV), also identified the corrosion products and the working conditions to treat the coins using a potentiostatic reduction method, which was monitored by chronoamperometry. The corrosion products showed that the decay mechanisms were dominated by selective attack on the copper-rich phases of the silver-copper alloys, which is consistent with an internal galvanic corrosion phenomenon, which leads to the deposition of copper corrosion products on the surface of the coins. Silver chloride was also detected on the coins, which reflects selective corrosion of the silver-rich phases under different chemical environments. The potentiostatic treatment showed excellent effectiveness in determining treatment parameters and monitoring the reduction process of the corrosion products on the coins, which helped to preserve surface details in the cleaning process and to prevent over-treatment.

Keywords : silver alloys, corrosion, conservation, heritage

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