

RESIDUAL STRESSES ANALYSIS IN BRUSH-PLATED GALVANIC COATINGS DEPOSITED FROM NICKEL SULFATE ELECTROLYTE

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Sometimes there arises the need to deposit a galvanic coating with a reasonable thickness in limited or selected surface areas of worn or mismachined large-sized parts. For this purpose, brush-plating (electrochemical metallizing) method has been employed [1]. Presence of residual stresses is typical for all coatings.

Residual stresses are investigated in hard coatings deposited from nickel sulfate electrolyte. To determine residual stresses, a conventional deformation method was used, where a coating is manually deposited on a strip substrate with slipping edges, which deforms without bending during deposition. The change in the axial strain of the free surface during the depositing process is measured by a self-temperature compensated strain gauge. The dependence of strain on coating thickness is used as experimental information. As the derivative of the strain parameter (whose values fluctuate to a great extent) in the calculation equations is presented in accordance with coating thickness, the experimental results were previously approximated by an analytical expression assuming that the dependence of residual stress on coating thickness is linear-fractional [2].

Residual stresses are also determined by the X- ray diffraction technique, based on the $\sin^2\psi$ method. Using the X- ray diffraction technique, residual stresses can be measured on the superficial layer of the coating at room temperature. For comparing the results obtained by the two methods, residual stresses determined by the deformation method at final coating thickness should be corrected taking into account thermal stresses. Uncertainties in measurement of residual stresses are evaluated.

The values of residual stresses determined in the surface layer, obtained by the mechanical and X-ray diffraction techniques, are comparable within a maximum limit of measurement uncertainty.

Keywords: strip substrate, coating, axial strain, X-ray diffraction, residual stress

References

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