Reduction of brass model corrosion layers using low-pressure low-temperature hydrogen plasma

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Plasmachemical reduction of corrosion layers is relatively new method developed by Stanislav Veprek et. al. at the end of the 20th century at Institute of Inorganic Chemistry, University of Zürich. It was broadly applied mainly for iron artifacts [1]. Before Veprek, Daniels used similar method for plasma reduction of silver tarnish on Daguerreotypes [2].

Brass samples were chosen for this study. Two sets of samples were prepared. Samples were placed into sandy environment and thus corrosive vapor formed a thick corrosion layer with incrustation. The second set of samples was prepared in the same corrosion atmosphere without sandy environment. The corrosion layers had been formed for one month in both cases.

The plasma treatment of prepared model samples was carried out in a Quartz cylindrical reactor (90 cm long and 9.5 cm in diameter). The reactor was surrounded by two external copper electrodes supplied by radio-frequency generator (13.56 MHz). The experiment took place in pure hydrogen at pressure of 150 Pa and constant flow rate of 50 sccm. Samples were treated at different plasma power of 100 W, 200 W, 300 W and 400 W in continual mode. The treatment duration was up to 120 minutes.

Plasmachemical process was monitored by optical emission spectroscopy. Data obtained from this method were used to calculate rotational temperatures and intensity of OH radicals that were used for the process monitoring. Temperature of sample during treatment was measured by thermocouple installed inside the sample. At the beginning of each process, intensity of OH radicals increased and thereafter decreased. Temperature of sample increased at the beginning of process (up to about 30 minutes) and thereafter it was constant. The temperature was nearly independent on the incrustation.

Acknowledgements

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References

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