

Electrochemical and Spectroscopic Characterization of Patinated Bronze Sculptures

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Bronze sculptures are usually covered by a layer of artificial patina, which is an important part of its visual identity. When continuously exposed to outdoor environment, i.e. rain, moisture condensation, salt and particle deposition and UV light, patina layer can dissolve or chemically transform, which is commonly noticed on statues exposed in urban areas. In some cases this process can lead to overall improvement of the patina and bronze stability, as the reactive patina components are dissolved or converted to more stable compounds. In other cases patina dissolution leads to increased porosity and enhances the dissolution of bronze substrate. In practice it is difficult to determine which of the above ascribed processes is taking place.

Electrochemical methods are important for determination of corrosion stability of metallic surfaces. For this reason, they are applied in this work to examine the corrosion properties of several bronze statues placed in polluted urban areas. Studied statues are covered by a black or green artificial patina layers and date from mid 20th century to beginning of 21st century. Electrochemical measurements were conducted within a three-year period by using a non-destructive method, electrochemical impedance spectroscopy (EIS). Analysis of the obtained impedance spectra showed that for some of the sculptures, patina did not change much that period, while on others an improvement or deterioration of patina stability occurred. Besides the EIS measurements, patina was examined by FTIR spectroscopy. However, EIS proved to be more sensitive to patina modification detection compared to FTIR spectroscopy.