Atmospheric corrosion monitoring of outdoor bronze works of art

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Abstract :The study of the degradation phenomena affecting bronze artworks exposed to outdoor atmospheric corrosion is fundamental to develop tailored preventive conservation strategies. The characterization of the corrosion products and the assessment of the atmospheric and microclimatic parameters affecting the material/environment interaction allows obtaining important information on the conservation state of the artworks and on the strategies to be implemented to ensure their safeguard. In this study an on-site monitoring campaign has been carried on several bronze artworks, of the Gori Art Collection, a private collection of environmental art exhibited at the Fattoria di Celle, Santomato (Pistoia, Italy). The on site monitoring campaign started in 2019 and it is still in progress by employing a multi-analitycal approach. At a first visual examination, the bronze artworks showed different corrosion morphologies related to the different exposure conditions to atmospheric agents; galvanic corrosion due to coupling between the bronze artworks and the steel grips used for their positioning was observed too. Electrochemical Impedance Spectroscopy (EIS), XRF and Raman spectroscopy allowed to determine the composition of the metallic alloys and of the corrosion products, as well as to assess the electrochemical behaviour and the protective effectiveness of the corrosion patinas. Moreover, it was possible to highlight the surfaces that were more exposed to the aggressive agents present in the atmosphere and to the washing action of the rain. A 3D photogrammetry survey is also performed to create a complete documentation of the artworks. The results of the monitoring campaign highlight the advantages of the proposed approach, and allow to discuss the challenges still open in the development of tailored safeguard methodologies for outdoor bronze artefacts.

Keywords Atmosferic corrosion, cultural heritage safeguard, electrochemical impedance spectroscopy, bronze artefacts, 3D virtual replicas

Reference

[1] L. Es Sebar, L. Iannucci, M. Parvis, S. Grassini, E. Angelini, Atmospheric corrosion of outdoor bronze artefacts: The case study of 'Katarsis', by Magdalena Abakanowicz, Journal of Physics: Conference Series, 2022.