

Characterization of cultural artefacts using electrochemical techniques

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Cultural artefacts are unique and must be conserved for future generations, even though a slow degradation is unavoidable. Adequate characterisation of elements belonging to their matter can provide precious information about origin, use and interaction with the environment. Among the numerous –often complementary – analytical methods used to evaluate the stability of the object as well as about the applicability of any treatment, electrochemical techniques are an outstanding alternative. They gather several of the requested advantages when working with cultural heritage, such as non invasiveness, quantitative and structural information, with a high precision.

In practice, surface products are collected by contacting the object with a paraffin impregnated graphite electrode (PIGE), which is next connected to a potentiostat in a classical 3-electrode electrochemical cell. By scanning the potential in the adequate range, current peaks are observed, which correspond to species reacting at the electrodes surface and allow their identification. Even with rather small amount of material, which can moreover be taken selectively, in a localized region, a very useful signal is obtained.

To perform materials identification an appropriate database was first established, by optimizing operational conditions so that metals and compounds could be assigned to observed oxidation or reduction peaks. The technique was then applied to answer different questions about provenance and manufacture of objects and also about the impact of the conservation conditions on their stability. Examples of investigation on historical and archaeological objects will be shown and discussed together with appropriateness of realized treatments and environmental conditions to conserve them.