

Corrosion of steel and iron alloys - methodology

MAJTÁS Dušan

All metallic objects of cultural heritage are prone to corrosion as well as any other metallic objects. Prior to any corrosion treatment material analysis should be done, as it is the key point for finding proper treatment. Through the literature research it has been found there are simplifications described in various papers on topic of corrosion, corrosion protection and restoration respectively. In addition there are information hidden as a part of common knowledge both in restoration and corrosion science. It has to be kept in mind: simplifications could be used, but only in specific situations, not as a generic “rule of thumb”. The analysis of both – the objects and the environment should be done to fully understand particular corrosion case. For the proper restoration not only the object itself, its composition and technology of its manufacture should have been taken into account. Also additional factors should be taken into account, such as the surrounding environment and the history of object-environment system. From this point of view it is clear that using simplification as a starting point for development of restoration procedure is unwise choice. The system has to be analyzed, then the restoration procedure for particular corrosion case might be developed in conclusion.

Various sets of samples both prepared in laboratory by accelerated ageing and the samples from real corrosion cases were examined. Structure of corrosion products was observed using optical microscopy and optical 3D microscopy. Main advantage of using 3D microscopy for analysis of historical objects and cultural heritage is the possibility to observe the surface as is. Preparing cross-sections is not needed.

To identify phase composition of the corrosion products in bulk XRD was used. To analyze distribution of phases through corrosion layer other technique should be considered such as EBSD or Raman spectroscopy. Raman spectroscopy gives information on phase composition of corrosion layers, but not on the grains. Using Raman microscope it is also possible to do mapping (both 1D and 2D), these are less time consuming compared to EBSD. Methodology used in this paper does consist of optical microscopy (both standard and 3D), XRD and μ -Raman microscopy, EBSD was not used. Results of the analysis point out there are similarities between corrosion products formed in different macroscopic conditions. Similar composition and similar layer structure formed during atmospheric conditions on sample where paint system was reapplied during the exposition and during the corrosion in soils.