CHARACTERIZATION OF GLASS CORROSION PROCESSES BY OPTICAL COHERENCE TOMOGRAPHY

Paweł Karaszkiewicz[1], Jerzy Kunicki-Goldfinger[2], Michalina Góra[3], Piotr Dzierżanowski[4]
[1]Faculty of Art Conservation and Restoration, Academy of Fine Arts, Kraków, Poland
[2]Institute of Nuclear Chemistry and Technology, Warszawa, Poland
[3]Institute of Physics, Nicolaus Copernicus University, Toruń, Poland
[4]Electron Microprobe Laboratory, Faculty of Geology, University of Warsaw, Warszawa, Poland
e-mail: zekarasz@cyf-kr.edu.pl

It this study the applicability of optical coherence tomography (OCT) in identification and characterisation of leached and hydrated glass surface layers has been assessed. The goal is to provide glass conservators and researchers with simple, convenient, quick and non-invasive method of monitoring and predicting of evolution of glass surface.
The reaction of glass with water of any form is called a corrosion process. Although this multi-phase processes is well documented, it is often very difficult to predict evolution of particular artefact. This is because the behaviour of a glass depends on many factors like its chemical composition, the manufacture conditions, the environmental history of the object, the quality of glass in terms of its homogeneity and the occurrence of various technological defects. If environmental parameters (RH, temperature, and the acidity or alkalinity (pH) of surrounding water) are stable, many kinds of even partly hydrated glass can remain stable in equilibrium with this environment for a quite long period of time. However, in some cases of so called unstable glass, reaching such an equilibrium is not possible. But even then, by careful planning and controlling the microenvironment and being aware of the glass surface state, it is possible to significantly slow down its further decomposition. Otherwise, the alteration of glass can even be enhanced.
Optical Coherence Tomography may be useful for frequent monitoring of such objects and for a quick screening of museum collections as well as stained glass windows to identify possible threat from the storage conditions.
In this contribution examples of OCT cross-sectional images of leached glass will be presented and compared with results obtained with other, more conventional (destructive) techniques. The composition of leached layer was assessed with Electron Probe Micro-Analysis (EPMA) whilst its thickness was visualised on cross-section with back scattered electrons (BSE) technique. It will be shown with historic samples, that the leached layer recognized on cross-sections with these techniques may be also found with OCT, but on non-destructive way. Consequently the advantages and limitations of the method will be discussed.