

EXAMINATION OF INSCRIPTIONS ON EASEL PAINTINGS WITH OCT

Ludmiła Tymińska-Widmer¹, Magdalena Iwanicka¹, Michalina Góra²,
Marcin Sylwestrzak², Bogumiła J. Rouba¹, Piotr Targowski²

¹Institute for the Study, Restoration and Conservation of Cultural Heritage,
Nicolaus Copernicus University, Gagarina 7, 87-100 Toruń, Poland

²Institute of Physics, Nicolaus Copernicus University, Grudziadzka 5, 87-100 Toruń, Poland
e-mail: lutym@umk.pl

Recently, potential of optical coherence tomography (OCT) has become more and more explored in heritage science since it is a one of unique techniques for non-contact and non-destructive imaging of inner structures of transparent and semitransparent elements of artworks.

Due to the ability to differentiate layers of various optical properties in the cross-sectional images of oil painting structure in fully non-invasive way, OCT has been applied by our team for specific practical applications such as estimation of the sequence of varnish and paint layers in the region of signature.¹⁻³ The analysis of this region, which cannot be sampled, is important both for attributing the artwork as well as for confirming its authenticity. The experiments show that OCT examination can be helpful when the signature is suspected to lay on original varnish or overpaintings but it is not apparent e.g. surface of the picture is covered with a secondary varnish with very strong UV-visible fluorescence.

The second application that will be presented relies on the utilisation of OCT for three-dimensional imaging of surface and inner structures of art works. Spectral OCT instruments collect a large quantity of data in a short time and thus are well suited for obtaining volume information. If the procedure of recognition of interfaces between layers of different optical properties (eg. air–varnish and varnish–paint layer) is applied to the volume data collected with OCT from the multi-layered structure of the varnished painting, it is possible to recover virtually profiles not only of the surface of the object but also of convex or concave details of its inner layers.^{2,4,5} Experiments carried out on models and examination of original paintings prove that OCT method can be useful for revealing textural painted inscriptions or marks increased in fresh paint layer levelled by a thick discoloured and hazy varnish or overpaintings permeable for near infrared utilised by OCT examination. The technique can be particularly helpful in cases when the inscriptions are not clearly recognisable with other methods e.g. observation in raking light.

Applicability of OCT for examination of inscriptions on oil paintings will be presented on results of examination carried out on models and real artworks.

Acknowledgment

The financial support form Polish Ministry of Science, grant for years 2008-2011, is gratefully acknowledged.

1. P. Targowski, M. Góra, T. Bajraszewski, M. Szkulmowski, M. Wojtkowski, A. Kowalczyk, B. Rouba, L. Tymińska-Widmer, M. Iwanicka “Optical coherence tomography for structural imaging of artworks” *Proc. of Lacona VII – Lasers in the Conservation of Artworks*, Madrid, Spain, 17 – 21 September 2007 – *in press*.
2. L. Tymińska-Widmer, P. Targowski, M. Góra, M. Iwanicka, T. Łękawa-Wysłouch, B. Rouba “Optical Coherence Tomography – a Novel Tool for the Examination of Oil Paintings”,

Proceeding of "Conservation Science 2007", 10-11 May 2007, Milano; Archetype Books – *in press*.

3. P. Targowski, B. Rouba, M. Góra, L. Tymińska-Widmer, J. Marczak, and A.Kowalczyk "Optical Coherence Tomography in Art Diagnostics and Restoration", *Applied Physics A* **92**, 1–9, (2008).
4. I. Gorczyńska, M. Wojtkowski, M. Szkulmowski, T. Bajraszewski, B. Rouba, A. Kowalczyk, P. Targowski, "Varnish Thickness Determination by Spectral Optical Coherence Tomography", *Springer Proceedings in Physics*, vol. **116**; Lasers in the Conservation of Artworks, LACONA VI Proceedings, Vienna, Austria, Sept. 21-25, 2005, J. Nimmrichter, W. Kautek, and M. Schreiner Editors, Springer Verlag, Berlin Heidelberg 2007, p.493–497.
5. P. Targowski, M. Góra, M. Wojtkowski "Optical coherence tomography for artwork diagnostics", *Laser Chemistry* **2006**: doi:10.1155/2006/35373, 11 pages (2006) <http://www.hindawi.com/journals/lc/>.