Inspection of panel paintings beneath gilded finishes using terahertz time-domain imaging

Scientific analysis of panel paintings could provide key information to art historians and conservators about the composition and condition of the constituent layers. Knowledge of the structure, stratigraphy, and condition of the subsurface layers of these objects is highly relevant to conservation measures, when stability problems such as delamination or internal cracking are considered. Terahertz time-domain imaging (THz-TDI) in reflection geometry is capable of highlighting interfaces between layers in a stratigraphic buildup, and thus makes structural information available in the form of subsurface 3D images and stratigraphic images (B-scans). The technique is contactless and non-invasive, and has been successfully applied to investigation of panel paintings. Regarding gilded panel paintings, the extremely high reflectivity of metals at submillimeter wavelengths generally precludes the transmission of electromagnetic waves through metallic films. Therefore, imaging of subsurface features below gilded finishes may be regarded as very challenging. A small but non-negligible direct transmission through metal films occurs if the film thickness is of the order of the skin depth of the metal in the terahertz range, due to the skin effect. The thickness of gold leaf, a fraction of a micrometer, matches the skin depth of gold in the terahertz frequency range covered by THz-TDI devices. We therefore investigated and imaged subsurface features of panel paintings through gilded finishes with THz-TDI. Subsurface layers of three gilded panel paintings (two contemporary tempera panel replicas and one fourteenth-century icon) have been successfully imaged behind gold finishes with THz-TDI.

General information
State: Published
Organisations: Department of Photonics Engineering, Cultural Heritage Science Open Source
Contributors: Dandolo, C. L. K., Cosentino, A., Jepsen, P. U.
Pages: S159-S166
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Studies in Conservation
Volume: 60
Issue number: SUPPLEMENT 1
ISSN (Print): 0039-3630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 0.48 SJR 0.352 SNIP 0.63
Web of Science (2017): Impact factor 0.613
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 0.55 SJR 0.404 SNIP 1.02
Web of Science (2016): Impact factor 0.578
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 0.3 SJR 0.26 SNIP 0.524
Web of Science (2015): Impact factor 0.323
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 0.54 SJR 0.371 SNIP 1.131
Web of Science (2014): Impact factor 0.506
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 0.23 SJR 0.229 SNIP 0.38
Web of Science (2013): Impact factor 0.173
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 0.39 SJR 0.222 SNIP 1.214
Web of Science (2012): Impact factor 0.34
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 0.42 SJR 0.279 SNIP 0.432