

## Contents

<b>Art in the Service of Science</b> <i>J.F. Asmus</i> .....	1
<hr/>	
<b>Part I Laser Cleaning of Paper</b>	
<hr/>	
<b>Laser Cleaning Investigations of Paper Models and Original Objects with Nd:YAG and KrF Laser Systems</b> <i>H. Scholten, D. Schipper, F.J. Ligterink, J.L. Pedersoli Jr., P. Rudolph, W. Kautek, J.B.G.A. Havermans, H.A. Aziz, B. van Beek, M. Kraan, P. van Dalen, V. Quillet, S. Corr, H.Y. Hua-Ströfer</i> .	11
<b>Anti-Fungal Laser Treatment of Paper: A Model Study with a Laser Wavelength of 532 nm</b> <i>E. Pilch, S. Pentzien, H. Mädebach, W. Kautek</i> .....	19
<b>Observation of the Post-Processing Effects due to Laser Cleaning of Paper</b> <i>K. Ochocińska-Komar, A. Kamińska, M. Martin, G. Śliwiński</i> .....	29
<b>The Post-Processing Effects due to Pulsed Laser Ablation of Paper</b> <i>A. Kamińska, M. Sawczak, M. Cieplinski, G. Sliwinski</i> .....	35
<b>Laser Cleaning of Pressure Sensitive Tapes on Paper</b> <i>J.H. Scholten, P. van Dalen, S. Corr, P. Rudolph, J.B.G.A. Havermans, H.A. Aziz, F.J. Ligterink</i> .....	43
<b>Chemistry of Parchment-Laser Interaction</b> <i>L. Puchinger, S. Pentzien, R. Koter, W. Kautek</i> .....	51

---

## Part II Laser Cleaning of Metal

---

### Femtosecond Laser Cleaning of Metallic Cultural Heritage and Antique Artworks

*T. Burmester, M. Meier, H. Haferkamp, S. Barcikowski, J. Bunte, A. Ostendorf* ..... 61

### Archaeological Ironwork: Removal of Corrosion Layers by Nd:YAG-Laser

*K. Dickmann, J. Hildenhagen, J. Studer, E. Müsch* ..... 71

### Laser Cleaning of Metal Surface – Laboratory Investigations

*P. Mottner, G. Wiedemann, G. Haber, W. Conrad, A. Gervais* ..... 79

### 1320 nm Range Nd:YAG-Laser in Restoration of Artworks Made of Bronze and Other Metals

*S. Batishche, A. Kouzmouk, H. Tatur, T. Gorovets, U. Pilipenka, V. Ukhau* ..... 87

### Surface Cleaning of Iron Artefacts by Lasers

*Y.S. Koh, I. Sárady* ..... 95

---

## Part III Laser Cleaning Miscellaneous

---

### Experimental and Theoretical Indications on Laser Cleaning

*J. Marczak, K. Jach, A. Sarzynski, R. Ostrowski* ..... 103

### Er:YAG Laser Applications on Marble and Limestone Sculptures with Polychrome and Patina Surfaces

*A. deCruz, M.L. Wolbarsht, R.A. Palmer, S.E. Pierce, E. Adamkiewicz* 113

### Lasers Cleaning of Patrimonial Plasters

*E. Tanguy, N. Huet, A. Vinçotte* ..... 125

### Overpaint Removal on a Gilded Wooden Bas-Relief Using a Nd:YAG Laser at 1.064 $\mu\text{m}$

*M. Strzelec, J. Marczak, A. Koss, R. Szambelan* ..... 133

### Pulsed Laser Cleaned Natural History Specimens with Reference to the Removal of Conductive Coatings

*L. Cornish, G. Miller, C. Jones* ..... 139

<b>Laser Cleaning Studies of Hard Insoluble Aluminosilicate Crusts on Minoan (LM IIIC) Pottery</b> <i>S. Chlouveraki, P. Pouli, K. Melessanaki, K. Zervaki, M. Yiannakaki</i> . . .	143
<b>Laser Removal of Protective Treatments on Limestone</b> <i>M. Gómez-Heras, E. Rebollar, M. Alvarez de Buergo, M. Oujja, R. Fort, M. Castillejo</i> . . . . .	149
<b>Comparison of Cleaning Methods for Stained Glass Windows</b> <i>H. Rörmich, P. Mottner, J. Hildenhausen, K. Dickmann, G. Hettinger, F. Bornschein</i> . . . . .	157
<b>Results of Nd:YAG Laser Renovation of Decorative Ivory Jug</b> <i>M. Strzelec, J. Marczak, R. Ostrowski, A. Koss, R. Szambelan</i> . . . . .	163
<hr/>	
<b>Part IV Case Studies</b>	
<hr/>	
<b>The Conservation Intervention on the <i>Porta della Mandorla</i></b> <i>S. Siano, A. Giusti, D. Pinna, S. Porcinai, M. Giamello, G. Sabatini, R. Salimbeni</i> . . . . .	171
<b>The Capability of the Laser Application for Selective Cleaning and the Removal of Different Layers on Wooden Artworks</b> <i>G. Wiedemann, K. Pueschner, H. Wust, A. Kempe</i> . . . . .	179
<b>The Pilot Restoration Yard of the Church of San Frediano in Pisa: Results of a Multidisciplinary Study</b> <i>C. Baracchini, R. Pini, F. Fabiani, M. Ciafaloni, S. Siano, R. Salimbeni, G. Sabatini, M. Giamello, M. Franzini, M. Lezznerini, M. Spampinato, F. Gravina, F. Andreazzoli</i> . . . . .	191
<b>A Bronze Age Pre-Historic Dolmen: Laser Cleaning Techniques of Paintings and Graffiti (The Bisceglie Dolmen Case Study)</b> <i>G. Daurelio</i> . . . . .	199

---

**Part V Side Effects**

---

- Evaluating the Effectiveness of Lasers for the Removal of Overpaint from a 20th C Minimalist Painting**  
*C. McGlinchey, C. Stringari, E. Pratt, M. Abraham, K. Melessanaki, V. Zafiropulos, D. Anglos, P. Pouli, C. Fotakis* ..... 209
- Evaluation of Laser Cleaning of Parchment Documents with a Q-Switched Nd:YAG Laser at 1064, 532 and 266 nm**  
*M. Vest, M. Cooper, R. Larsen* ..... 217
- Cleaning of Soiled White Feathers Using the Nd:YAG Laser and Traditional Methods**  
*C. Dignard, W.-F. Lai, N. Binnie, G. Young, M. Abraham, S. Scheerer* 227
- Surface Analysis of the Laser Cleaned Metal Threads**  
*M. Sokhan, F. Hartog, D. McPhail* ..... 237

---

**Part VI Pigments, Conservation Layers**

---

- The Effects of Laser Radiation on Adhesives, Consolidants, and Varnishes**  
*O. Madden, M. Abraham, S. Scheerer, L. Werden* ..... 247
- A Study on the Oxidative Gradient of Aged Traditional Triterpenoid Resins Using “Optimum” Photoablation Parameters**  
*C. Theodorakopoulos, V. Zafiropulos, C. Fotakis, J.J. Boon, J. v.d. Horst, K. Dickmann, D. Knapp* ..... 255
- Evaluation of the Effects of Laser Irradiation on Modern Organic Pigments**  
*M. Abraham, O. Madden, T. Learner, C. Havlik* ..... 263
- Laser Paint Interactions Studied by Optical Emission Spectroscopy and Pump and Probe Analysis of the Ablation Plume**  
*E. Rebollar, M. Oujja, M. Martín, M. Castillejo* ..... 277
- Effects of Laser Irradiation on Artwork Pigments Studied by Laser Ablation and Time-of-Flight Mass Spectrometry**  
*R. Torres, M. Jadraque, M. Castillejo, M. Martín* ..... 285
- IR-Laser Effects on Pigments and Paint Layers**  
*A. Schnell, L. Goretzki, Ch. Kaps* ..... 291

<b>Reaction of Historical Colours and their Components Irradiated at Different Nd:YAG Laser Wavelengths (<math>\omega</math>, <math>2\omega</math>, <math>3\omega</math>, <math>4\omega</math>)</b> <i>J. Hildenhagen, M. Chappé, K. Dickmann</i> .....	297
<b>Visual Effect of Laser Cleaning on Orissan Murals</b> <i>A. Sah</i> .....	303
<hr/> <b>Part VII Fundamentals, Innovative Methods</b> <hr/>	
<b>Synchronous Use of IR and UV Laser Pulses in the Removal of Encrustation: Mechanistic Aspects, Discoloration Phenomena and Benefits</b> <i>V. Zafiropulos, P. Pouli, V. Kylikoglou, P. Maravelaki-Kalaitzaki, B.S. Luk'yanchuk, A. Dogariu</i> .....	311
<b>Numerical Modelling of Laser Cleaning and Conservation of Artworks</b> <i>J. Marczak, K. Jach, A. Sarzyński</i> .....	319
<b>Laser Signal Dependence on Artworks Surface Characteristics: A Study of Frescoes and Icons Samples</b> <i>E. Esposito, P. Castellini, N. Paone, E.P. Tomasini</i> .....	327
<b>Pollution Encrustation Removal by Means of Combined Ultraviolet and Infrared Laser Radiation: The Application of this Innovative Methodology on the Surface of the Parthenon West Frieze</b> <i>P. Pouli, K. Frantzikinaki, E. Papakonstantinou, V. Zafiropulos, C. Fotakis</i> .....	333
<b>Mössbauer and XRD Study of the Effect of Nd:YAG-1064 nm Laser Irradiation on Hematite Present in Model Samples</b> <i>M. Gracia, M. Gaviño, V. Vergès-Belmin, B. Hermosin, W. Nowik, C. Sáiz-Jiménez</i> .....	341
<b>Can Laser Microprobe Mass Analysis do any Work in Artwork Conservation?</b> <i>R. Wurster</i> .....	347
<b>An X-Ray Microprobe for In-Situ Stone and Wood Characterization</b> <i>P. Lovoí, J.F. Asmus</i> .....	353

XII Contents

<b>Non-Invasive Monitoring of Water Intake in Limestones</b> <i>P. Prado, J.F. Asmus</i> .....	357
---	-----

<b>Nd, Er and Excimer Laser Sources: Laboratory Evaluation of Cleaning Efficacy and of Interaction with Substrate</b> <i>A. Sansonetti, M. Realini, L. Toniolo, G. Valentini</i> .....	363
---	-----

---

**Part VIII Working Groups and Networks**

---

<b>Euregio-Center of Expertise for Art Conservation Technology</b> <i>G. von Bally, K. Dickmann, D. Schipper</i> .....	371
---	-----

<b>COST G7 Action Creates a Durable Instrument for Advanced Research Implementation in Artwork Conservation by Laser</b> <i>R. Radvan</i> .....	381
--	-----

<b>The Project OPTOCANTIERI: A Synergy between Laser Techniques and Information Science for Arts Conservation</b> <i>R. Salimbeni, R. Pini, S. Siano</i> .....	389
---	-----

<b>Spanish Thematic Network on Cultural Heritage</b> <i>M. Castillejo, M.-T. Blanco, C. Sáiz-Jiménez</i> .....	395
---	-----

---

**Part IX Cleaning Stations and Process Control  
for Practise**

---

<b>Laser Cleaning System for Automated Paper and Parchment Cleaning</b> <i>W. Kautek, S. Pentzien</i> .....	403
--	-----

<b>Laser Cleaning Monitored by a Spectroscopic Technique – Experimental Data on The Gotlandic Sandstone Case</b> <i>M. Jankowska, K. Ochocińska, G. Śliwiński</i> .....	411
--	-----

<b>From the Research Lab to the Restoration Yard: Practical Procedures to Evaluate <i>in situ</i> the Use of Laser Cleaning on Façades</b> <i>R. Pini, C. Baracchini</i> .....	419
---	-----

<b>Sensor Concept for Controlled Laser Cleaning via Photodiode</b> <i>M. Lentjes, D. Klomp, K. Dickmann</i> .....	427
--	-----

<b>Ultra-Stable, New Generation Q-Switched Monolithic Laser Cleaners for Fine Art Conservation</b> <i>F. Brioschi, P. Salvadeo</i> .....	435
---	-----

---

## **Part X Spectroscopy for Monitoring and Identification**

---

<b>Analysis of Archaeological Objects with LMNTI, a New Transportable LIBS Instrument</b> <i>K. Melessanaki, A. Mastrogiannidou, S. Chlouveraki, S.C. Ferrence, P.P. Betancourt, D. Anglos</i> .....	443
---	-----

<b>Spectroscopic Monitoring of the Laser Cleaning Applied to Ancient Marbles from Mediterranean Areas</b> <i>V. Lazic, F. Colao, R. Fantoni, L. Fiorani, A. Palucci, J. Striber, A. Santagata, A. Morone, V. Spizzicchino</i> .....	451
--	-----

---

## **Part XI Laser Diagnostics**

---

<b>Artwork Monitoring by Digital Image Correlation</b> <i>K.D. Hinsch, G. Gülker, H. Hinrichs, H. Joost</i> .....	459
--	-----

<b>A 3D Scanning Device for Architectural Relieves Based on Time-Of-Flight Technology</b> <i>M.C. Gambino, R. Fontana, G. Gianfrate, M. Greco, L. Marras, M. Materazzi, E. Pampaloni, L. Pezzati</i> .....	469
---	-----

<b>Surface Roughness Relief</b> <i>L. Marras, R. Fontana, M.C. Gambino, M. Greco, M. Materazzi, E. Pampaloni, L. Pezzati, P. Poggi</i> .....	477
---	-----

<b>Integration of Imaging Analysis and 3D Laser Relief of Artworks: A Powerful Diagnostic Tool</b> <i>L. Marras, R. Fontana, M.C. Gambino, M. Greco, M. Materazzi, E. Pampaloni, A. Pelagotti, L. Pezzati, P. Poggi</i> .....	485
--	-----

<b>Parallel Acquisition of 3-D Surface Coordinates and Deformations by Combining Electronic Speckle Pattern Interferometry and Optical Topometry</b> <i>D. Dirksen, B. Kemper, A. Guttzeit, G. Bischoff, G. von Bally</i> .....	493
--	-----

<b>Scanning Laser Doppler Vibrometry Application to Artworks: New Acoustic and Mechanical Exciters for Structural Diagnostics</b> <i>A. Agnani, E. Esposito</i> .....	499
--	-----

**Supporting the Restoration of the Minerva of Arezzo**

*M.C. Gambino, R. Fontana, M. Greco, E. Pampaloni, L. Pezzati,  
P. Pingi, P. Cignoni, R. Scopigno*..... 505

**Comparative Holography in the Conservation Structural  
Diagnosis: An El Greco Exemplary Exploitation**

*V. Tornari, A. Bonarou, V. Zafiropulos, C. Fotakis, N. Smyrnakis,  
S. Stassinopoulos* ..... 513

**A Case Study of Frescoes Diagnostics  
by Scanning Laser Doppler Vibrometry (SLDV):  
The Brumidi Corridors and The President's Room  
at The United States Capitol**

*G. Adams, J. Bucaro, E. Esposito, A.J. Kurdila, B. Marchetti,  
E.P. Tomasini, J.F. Vignola* ..... 525



Lasers in the Conservation of Artworks

LACONA V Proceedings, Osnabrück, Germany, Sept.  
15-18, 2003

Dickmann, K.; Fotakis, C.; Asmus, J.F. (Eds.)

2005, XXII, 530 p., Hardcover

ISBN: 978-3-540-22996-4