

Optical Security and Counterfeit Deterrence Techniques VI

Rudolf L. van Renesse Chair/Editor

17–19 January 2006 San Jose, California USA

Sponsored and Published by IS&T—The Society of Imaging Science and Technology SPIE—The International Society for Optical Engineering

SPIE Vol. 6075

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publishers are not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

e-First Publication for Proceedings: As of July 2005, papers in the Proceedings of SPIE are first published electronically in the SPIE Digital Library (www.spiedl.org), and subsequently in print and CD-ROM.

Pagination system: The new citation format uses six-digit article identifier numbers (CIDs). Utilization of article CIDs allows proceedings articles to be fully citable as soon as they are published online, using the same identifier for both online and print versions.

The structure of the six-digit article CID number for Proceedings of SPIE is:

- The first four digits indicate the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. The CID number appears on each page, followed by the page number within the actual article.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in Optical Security and Counterfeit Deterrence Techniques VI, edited by Rudolf L. van Renesse, Proceedings of SPIE-IS&T Electronic Imaging, SPIE Vol. 6075, Article CID Number (2006).

ISSN 0277-786X ISBN 0-8194-6115-6

Copublished by

SPIE—The International Society for Optical Engineering

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone 1 360/676-3290 (Pacific Time) · Fax 1 360/647-1445 http://www.spie.org and

IS&T—The Society for Imaging Science and Technology

7003 Kilworth Lane, Springfield, Virginia, 22151 USA Telephone 1 703/642-9090 (Eastern Time) Fax 1 703/642-9094 http://www.imaging.org

Printed in the United States of America Vm7 i ffUb 5ggcWJUhY gr to XYf WbgY Zrca GD-9.

Copyright © 2006, The Society of Photo-Optical Instrumentation Engineers and The Society for Imaging Science and Technology.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE and IS&T subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$15.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at http://www.copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/06/\$15.00.

Contents

- vii Conference Committee
- ix Introduction

SESSION 1 CURRENCY I

- 607501 **Public feedback for better banknote design** [6075-01] H. A. M. de Heij, De Nederlandsche Bank NV (Netherlands)
- 607502 Robust and reliable banknote authentification and print flaw detection with opto-acoustical sensor fusion methods [6075-02]
 V. Lohweg, Lippe and Hoexter Univ. of Applied Sciences (Germany); J. Schaede, KBA-Giori S.A. (Switzerland); T. Türke, KBA-Bielefeld (Germany)
- 607503 **The implication of direct laser engraved intaglio plates on banknote security** [6075-03] H. Deinhammer, D. Schwarzbach, R. Kefeder, P. Fajmann, Oesterreichische Banknoten- und Sicherheitsdruck GmbH (Austria)
- 607504 **Public education by central banks on the Internet** [6075-39] R. L. van Renesse, VanRenesse Consulting (Netherlands)

SESSION 2 CURRENCY II

- 607505 Circulation simulator method for evaluating bank note and optical feature durability [6075-04] W. J. Bartz, T. T. Crane, Crane & Co., Inc. (USA)
- 607506 Visual and optical evaluation of bank notes in circulation [6075-05]
 - S. Church, M. Lacelle, T. Garanzotis, Bank of Canada (Canada)
- 607507 The mechanisms of human recognition as a guideline for security feature development [6075-06]
 J. Schaede, KBA-Giori S.A. (Switzerland); V. Lohweg, Lippe and Hoexter Univ. of Applied Sciences (Germany)

SESSION 3 SECURITY IMAGE TECHNOLOGY I

- 607508 **Qualification of security printing features** [6075-07] S. J. Simske, J. S. Aronoff, Hewlett-Packard Labs. (USA); J. Arnabat, Hewlett-Packard Co. (Spain)
- 607509 **Potentiality of holographic technique in fragile watermarking (Invited Paper)** [6075-08] G. Schirripa Spagnolo, M. De Santis, Univ. degli Studi Roma Tre (Italy)
- 60750A Secure graphical data storage by full spectrum image coding [6075-09] H. Oltmans, Security Printing Consultant (Netherlands)

- 60750B **Sub-pixel analysis to support graphic security after scanning at low resolution** [6075-10] B. Haas, R. Cordery, Pitney Bowes (USA); H. Gou, University of Maryland, College Park (USA); S. Decker, Heron Innovation (USA)
- 60750C **New applications of modulated digital images in document security** [6075-11] R. A. Lee, P. W. Leech, L. D. McCarthy, G. F. Swiegers, Commonwealth Scientific and Industrial Research Organisation (Australia)

SESSION 4 SECURITY IMAGE TECHNOLOGY II

- 60750D Black fluorescent ink and applications [6075-37] J. Auslander, R. Cordery, Pitney Bowes Inc. (USA)
- 60750E **The role of optics in secure credentials** [6075-13] T. L. Lichtenstein, LaserCard Corp. (USA)
- 60750F **Practical use of lens structures in ID documents** [6075-14] J. van den Berg, Sdu Identification (Netherlands)
- 60750G Three-dimensional floating images as overt security features [6075-15] D. S. Dunn, T. L. Potts, L. E. Lorimor, J. M. Jonza, R. M. Smithson, S. P. Maki, 3M Co. (USA)
- 60750H **Development of the random-retardation-encoding anti-counterfeiting technology** [6075-16] W.-J. Huang, C.-H. Tsai, T.-J. Chen, M. Kuan, C.-H. Wen, Industrial Technology Research Institute (Taiwan)

SESSION 5 SECURITY INK TECHNOLOGY

- 607501 Advanced verification methods for OVI security ink [6075-17] P. G. Coombs, S. F. McCaffery, T. Markantes, Flex Products JDS Uniphase Corp. (USA)
- 60750J **Overt security features through digital printing** [6075-18] M. Hampden-Smith, S. Haubrich, R. Kornbrekke, J. Shah, R. Bhatia, N. Hardman, R. Einhorn, Cabot Corp. (USA)
- 60750K Novel particulate production processes to create unique security materials [6075-19] M. Hampden-Smith, T. Kodas, S. Haubrich, M. Oljaca, R. Einhorn, D. Williams, Cabot Corp. (USA)
- 60750L Combining overt and covert anti-counterfeiting technologies for securities [6075-20] T. Uematsu, National Printing Bureau (Japan)
- 60750M **Bacteriorhodopsin-based multilevel optical security features** [6075-21] N. Hampp, M. Neebe, Univ. of Marburg (Germany)
- 60750N **Optical security in ink: an industry standard that continues to evolve** [6075-22] M. Schmid, SICPA S.A. (Switzerland)

SESSION 6 OPTICALLY VARIABLE DEVICES I

- 607500 Use and efficacy of DOVIDs and other optical security devices [6075-23] I. M. Lancaster, Reconnaissance International Ltd. (United Kingdom) and International Hologram Manufacturing Association (United Kingdom)
- 60750P The security enhancement of diffractive optically variable image devices [6075-24] A. Argoitia, R. Phillips, Flex Products Inc./JDSU Co. (USA)
- 60750Q The Aztec structure: an improved replicable security device [6075-25] J. J. Cowan, Aztec Systems, Inc. (USA)
- 60750T **Use of metameric filters for future interference security image structures** [6075-42] B. Baloukas, S. Larouche, L. Martinu, École Polytechnique, Montréal (Canada)

SESSION 7 OPTICALLY VARIABLE DEVICES II

- 60750U Novel optically variable color devices [6075-27] M. Stalder, F. Seils, Rolic Technologies Ltd. (Switzerland)
- 60750V **Diffractive moiré features for optically variable devices** [6075-28] A. Schilling, W. R. Tompkin, R. Staub, OVD Kinegram Corp. (Switzerland); R. D. Hersch, S. Chosson, I. Amidror, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

SESSION 8 AUTHENTICATION, IDENTIFICATION, AND BIOMETRICS I

- 60750X Choosing the correct forensic marker(s) in currency, document, and product protection [6075-30] J. J. Plimmer, Product & Image Security Foundation (United Kingdom)
- 60750Y **Optically variable threads and polarization effects** [6075-38] F. Kretschmar, T. Burchard, M. Heim, Louisenthal (Germany)
- 60750Z Life recognition based on color variations in fingerprint images of live and artificial fingers
 [6075-32]
 K. Tai, M. Kurita, I. Fujieda, Ritsumeikan Univ. (Japan)
- 607510 **RFID identity theft and countermeasures** [6075-33] A. Herrigel, Up-Great AG (Switzerland); J. Zhao, MediaSec Technologies LLC (USA)
- 607511 Recording of the optical identification marks on CD [6075-40]
 A. A. Kryuchyn, Institute for Information Recording (Ukraine); S. A. Kostyukevych, V. Lashkaryov Institute of Semiconductor Physics (Ukraine); V. V. Petrov, V. G. Kravets, S. M. Shanoylo, Institute for Information Recording (Ukraine)

SESSION 9 AUTHENTICATION, IDENTIFICATION, AND BIOMETRICS II

607512 On the use of mobile imaging devices for the validation of first- and second-line security features [6075-34] T. Rodriguez, M. Weaver, Digimarc Corp. (USA)

607513 **Facets of color laser marking in high-security ID documents** [6075-35] F. Kappe, M. Schumacher, K. Schäfer, M. Hillebrand, M. Hennemeyer-Schwenkner, D. Fischer, ORGA Systems GmbH (Germany)

607514 **Protection of data carriers using secure optical codes** [6075-36] J. A. Peters, A. Schilling, R. Staub, W. R. Tompkin, OVD Kinegram Corp. (Switzerland)

Author Index