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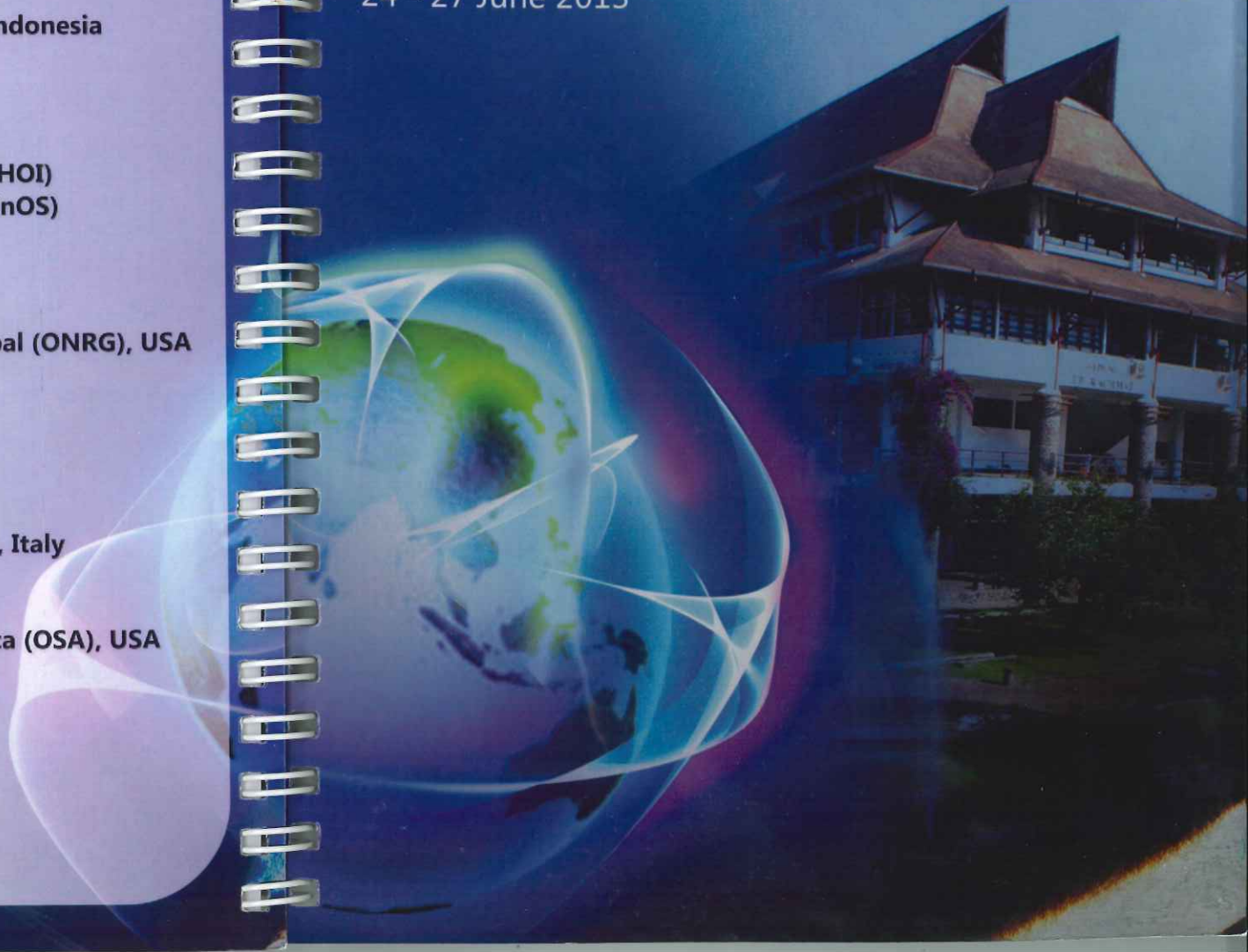
ISMOA 2013

9th International Symposium on Modern Optics and Its Applications

Notes

24 - 27 June 2013



9th International Symposium on *Modern Optics and Its Applications* (ISMOA 2013)

Monday, 24 June 2013

Venue : Department of Physics, Institut Teknologi Bandung

08.00 – 08.30	Registration
08.30 – 08.40	Opening Ceremony of Tutorial Courses on Modern Optics and Its Applications Opening Address by the Dean of the Faculty of Mathematics and Natural Sciences, ITB
08.40 – 09.30	Lecture Session 1 : *Group theory for nanophotonics - Application to eigenmodes of Photonic Crystals: localized modes, Bloch modes, uncoupled modes* **Kazuaki SAKODA** (National Institute for Material Science (NIMS), Japan)
09.30 – 10.20	Lecture Session 2 : *Group theory for nanophotonics - Application to Metamaterials: CRLH bands, Dirac cone, Double Dirac cones* **Kazuaki SAKODA** (National Institute for Material Science (NIMS), Japan)
10.20 – 10.40	Coffee Break
10.40 – 11.30	Lecture Session 3 : *Introduction to Design of Metamaterials* **S. Anantha RAMAKRISHNA** (Indian Institute of Technology, Kanpur, India)
11.30 – 12.20	Lecture Session 4 : *Selected Applications of Metamaterials* **S. Anantha RAMAKRISHNA** (Indian Institute of Technology, Kanpur, India)
12.20 – 13.20	Lunch
13.20 – 14.10	Lecture Session 5 : *Photonics and Nonlinear Optics of Nematic and Blue-Phase Liquid Crystals* **Iam-Choon KHOO** (Pennsylvania State University, USA)
14.10 – 15.00	Lecture Session 6 : *Liquid Crystals for tunable Metamaterial and Plasmonic Nano-photonic Structures* **Iam-Choon KHOO** (Pennsylvania State University, USA)
15.00 – 15.20	Coffee Break
15.20 – 16.10	Lecture Session 7 : *Very Small Laser* **Yong-Hee LEE** (Korea Advanced Institute for Science and Technology, Korea)
16.10 – 17.00	Lecture Session 8 : *Very Small Laser* **Yong-Hee LEE** (Korea Advanced Institute for Science and Technology, Korea)
17.00	Welcoming Reception

9th International Symposium on *Modern Optics and Its Applications* (ISMOA 2013)

Tuesday, 25 June 2013

Venue : Auditorium East Campus Center, Institut Teknologi Bandung

08.00 – 08.40 Registration
08.40 – 09.00 Opening Ceremony of 9th International Symposium on Modern Optics and Its Applications
Opening Address by the Rector of Institut Teknologi Bandung

1st session **Chairperson :** *Iam-Choon KHOO*

09.00 – 09.30 *Invited Paper-1* : *Nonlinear optical phononics: harnessing sound and light in nonlinear nanoscale circuits*
Benjamin J. EGGLETON, and Ravi PANT (Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS), Institute of Photonics and Optical Science (IPOS), School of Physics, The University of Sydney, Australia)

09.30 – 10.00 *Invited Paper-2* : *Frequency conversion in anomalous dispersion medium*
Huaijin REN, Ning AN, Yuanlin ZHENG and Xianfeng CHEN (Department of Physics, Shanghai Jiao Tong University, China)

10.00 – 10.30 Coffee Break

2nd session **Chairperson :** *Benjamin J. EGGLETON*

10.30 – 11.00 *Invited Paper-3* : *Sub-wavelength Metallic Lasers and High-n Metamaterials*
Yong-Hee LEE, Hong-Gyu PARK and Bum-Ki MIN (Department of Physics, Korea Advanced Institute of Science and Technology, Korea)

11.00 – 11.30 *Invited Paper-4* : *Carrier-envelope phase locked laser pulse with continuous color tunability*
Atsushi YABUSHITA, Chih-Hsien KAO, Ding-Yi JUANG, Andrius BALTUSKA, Takayoshi KOBAYASHI (Department of Electrophysics, National Chiao-Tung University, Taiwan)

11.30 – 12.00 *Invited Paper-5* : *Electro-Optic Modulators Utilizing Array Antenna Electrodes and Polarization-Reversed Structures*
Hiroshi MURATA and Yasuyuki OKAMURA (Graduate School of Engineering Science, Osaka University, Japan)

12.00 – 13.00 Lunch Break

Poster session **Chairpersons :** *Rustam E. SIREGAR and Alexander A. ISKANDAR*

13.00 – 14.30 Oral Introduction to Poster Presentations
14.30 – 16.30 Poster Session and Coffee Break

18.00 – 21.00 Banquet

9th International Symposium on *Modern Optics and Its Applications* (ISMOA 2013)

Wednesday, 26 June 2013

3th session **Chairperson :** *Kazuaki SAKODA*

08.30 – 09.00 *Invited Paper-6* : *Polarization independent and alignment-free Blue-phase liquid crystalline metamaterials and nanostructures for all-optical switching*
Iam-Choon KHOO (Electrical Engineering Department, The Pennsylvania State University, USA)

09.00 – 09.30 *Invited Paper-7* : *Optomechanical nonlinearities in metamaterials*
Mikhail LAPINE (CUDOS, School of Physics, The University of Sydney, Australia)

09.30 – 10.00 *Invited Paper-8* : *Super structures of columnar thin films : Photonic properties and their applications*
S. A. RAMAKRISHNA, Jhuma DUTTA (Department of Physics, Indian Institute of Technology Kanpur, India)

10.00 – 10.30 Coffee Break

4th session **Chairperson :** *Hugo J.W.M. HOEKSTRA*

10.30 – 11.00 *Invited Paper-9* : *Application of Multi-layered Silver Particle 2D Crystalline Films*
Kaoru TAMADA (Institute for Materials Chemistry and Engineering, Kyushu University, Japan)

11.00 – 11.30 *Invited Paper-10* : *Laser Ablation of Polymers by Three-Beam Interference*
Jintang HUANG, Si WU, Christoph BUBECK (Max Planck Institute for Polymer Research, Mainz, Germany)

11.30 – 12.00 *Invited Paper-11* : *Fabrication for large scale nanooptics*
Ernst-Bernhard KLEY, Dennis LEHR, Kay DIETRICH, Thomas WEBER, Thomas SIEFKE, Wiebke FREESE, Holger SCHMIDT (Institute of Applied Physics, Friedrich-Schiller-University, Jena, Germany)

12.00 – 12.15 Group Photo

12.15 – 13.15 Lunch Break

5th session **Chairperson :** *Maria A. LOI*

13.15 – 13.30 *Contributed Paper*-1 : *Polarization-coupling cascading in MgO doped periodically poled lithium niobate crystal*
Juan HUO and Xianfeng CHEN (Department of Physics, Shanghai Jiao Tong University, China)

13.30 – 13.45 *Contributed Paper-2* : *Semiconducting Single-Walled Carbon Nanotubes on Demand by Polymer Wrapping*
Widianta GOMULYA, Guadalupe Diaz COSTANZO, Elton J. F. de CARVALHO, Satria Z. BISRI, Vladimir DERENSKYI, Martin FRITSCH, Nils FRÖHLICH, Sybille ALLARD, Pavlo GORDIICHUK, Andreas HERRMANN, Siewert J. MARRINK, Maria C. dos SANTOS, Ullrich SCHERF, Maria A. LOI (Zernike Institute for Advanced Materials, University of Groningen, Netherlands)

13.45 – 14.00 *Contributed Paper-3* : *Group Velocity Control of Femtosecond Pulse in Folded Dielectric Axes Structures with Electro-Optic Effect*

Jun LI, Xuewei DENG, and Xianfeng CHEN (Department of Physics, Shanghai Jiao Tong University, China)

14.00 – 14.15 *Contributed Paper-4* : *Optical Response of a Nanohybrid: Molecular Dimer + Metal Nanoparticle*
Bintoro S. NUGROHO, Alexander A. ISKANDAR, Victor A. MALYSHEV, Jasper KNOESTER (Zernike Institute for Advanced Materials, University of Groningen, Netherlands)

14.15 – 14.30 *Contributed Paper-5* : *Controlling spontaneous emission in a truncated charge-sheet super-lattice*
Agus M. HATTA and Ali A. KAMLI (Engineering Physics Department, Institut Teknologi Sepuluh Nopember, Indonesia)

14.30 – 14.45 *Contributed Paper-6* : *Raman Spectroscopic Studies of Spin-Lattice Coupling in Iron Jarosite*
I.P. HANDAYANI, A.J.C. BUURMA, A.A. NUGROHO, T.T.M. PALSTRA, P.H.M. van LOOSDRECHT (Zernike Institute for Advanced Materials, University of Groningen, Netherlands)

14.45 – 15.15 Coffee Break

15.15 Excursion

9th International Symposium on *Modern Optics and Its Applications* (ISMOA 2013)

Thursday, 27 June 2013

6th session **Chairperson :** *Christoph BUBECK*

08.30 – 09.00 *Invited Paper-12* : *Microoptical array projection – beyond the limits of conventional digital projectors*
A. BRÄUER, M. SIELER, P. SCHREIBER (Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Jena, Germany)

09.00 – 09.30 *Invited Paper-13* : *Integrated Optics Sensors: Theory and Device Implementations*
H.J.W.M. HOEKSTRA (MESA+ Institute for Nanotechnology, University of Twente, The Netherlands)

09.30 – 10.00 *Invited Paper-14* : *Optical Interconnect Device Technology*
Okihiro SUGIHARA and Toshikuni KAINO (Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Japan)

10.00 – 10.30 Coffee Break

7th session **Chairperson :** *Xianfen CHENG*

10.30 – 11.00 *Invited Paper-15* : *Charge transfer state in organic solar cells*
Maria Antonietta LOI (Zernike Institute for Advanced Materials, University of Groningen, The Netherlands)

11.00 – 11.30 *Invited Paper-16* : *Mode Symmetries Required for Creating Photonic Dirac Cones in the Brillouin-Zone Center*
Kazuaki SAKODA (Photonic Materials Unit, National Institute for Materials Science, Japan)

11.30 – 12.00 *Invited Paper-17* : *Ultrafast magnetization dynamics in a ferromagnetic semiconductor*
Michiel DONKER, Simone ALTENDORF, Niko PONTIUS, Matteo MONTAGNESE, Dmitry MAZURENKO, Ronny SUTARTO, Liu Hao TJENG, Hermann DÜRR, and Paul H.M. van LOOSDRECHT (University of Groningen, Groningen, The Netherlands, and II. Physikalisches Institut, Universität zu Köln, Germany)

12.00 – 13.00 Lunch Break

8th session **Chairperson :** *S.A. RAMAKHRISNA*

13.00 – 13.15 *Contributed Paper-7* : *Fabrication of Nano-Engineered Zirconia–Yttria–Aluminosilicate Glass Co-doped with Erbium and its Applications*
Harith AHMAD, K. THAMBIRATNAM and S. W. HARUN (Photonics Research Centre, University of Malaya, Malaysia)

13.15 – 13.30 *Contributed Paper-8* : *Combining light trapping structures to enhance thin film solar cells*
Aimi ABASS and Bjorn MAES (Electronics and Information Systems, University of Gent, Belgium)

13.30 – 13.45 *Contributed Paper-9* : *X-Cut Ti:LiNbO3 Optical Modulator Suspended to Gap-Embedded Patch Antennas on Low-k Dielectric Substrate*
Yusuf N. WIJAYANTO, Hiroshi MURATA, Tetsuya KAWANISHI, Yasuyuki OKAMURA (Graduate School of Engineering Science, Osaka University, Japan)

13.45 – 14.00 *Contributed Paper-10* : *Fabrication and characterization of sub-100-nm sized split ring resonators for achieving magnetic resonance in visible spectrum*
Landobasa Y.M. TOBING, Liliana TJAHJANA, Dao Hua ZHANG (Nanophotonics Laboratory, Nanyang Technological University, Singapore)

14.00 – 14.15 *Contributed Paper-11* : *Mode-locked 1900 nm Fiber Laser Based Graphene Saturable Absorber*
Sulaiman W. HARUN, D. I. M. ZEN, N. SAIDIN, S. S. A. DAMANHURI, H. AHMAD, M. A. ISMAIL, A. HALDER, M. C. PAUL, S. DAS, M. PAL, and S. K. BHADRA (Photonics Research Centre, University of Malaya, Malaysia)

14.15 – 14.30 *Contributed Paper-12* :
F.D. MUHAMMAD, M. Z. ZULKIFLI, H. AHMAD (Photonics Research Centre, University of Malaya, Malaysia)

14.30 – 14.45 *Contributed Paper-13* : *Rigorous Method for Multimode Polymer Optical Waveguide Evaluations*
Freddy S. TAN, Okihiro SUGIHARA, and Toshikuni KAINO (Institute of Multidisciplinary Research for Advanced Material, Tohoku University, Japan)

14.45 – 15.15 Closing Ceremony

15.15 – 15.45 Coffee Break

Indonesian Optical Society Session

15.45 – 16.30 *General Meeting of the Indonesian Optical Society*

International Symposium on Modern Optics and Its Applications – 2013

Combining light trapping structures to enhance thin film solar cells

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Driven by the demand for affordable clean energy, many light trapping strategies to enhance thin film solar cells have been explored. The development of nanofabrication technology supported this drive by enabling us to access many wavelength scale photonic phenomena useful for light trapping. However, no single photonic phenomena can be relied upon to improve light absorption in the whole spectral range of interest as they tend to be effective only in a limited wavelength range. Furthermore, the requirements of different photonic phenomena for optimum enhancement often conflict with each other. Thus, one can never excite utilize them simultaneously with great efficiency with just a single photonic element.

Here, we discuss light trapping strategies that combine different photonic structures which provide coherent and incoherent scattering effects. Dual interface grating structures (DIGs) and combined front grating-back diffuser structures will be presented. By having multiple light trapping elements in a solar cell, we have more flexibility in optimizing each structure as we can split the functionality.

Firstly we will show a light trapping strategy that utilize DIGs in which we combine a front and back grating together. This strategy aims especially to enhance thin film cells of a few wavelengths thick and less through mainly utilizing guided modes.

We demonstrate that more and different kinds of guided modes can be efficiently excited with DIGs. Here, we discuss the usage of a back metal grating together with a front dielectric grating to enhance thin film a-Si and c-Si cells though there are other possible combinations. We will discuss how additional modification of the DIGs by introducing dual periodicity and blazing enables it to further outperform single grating configurations. Fig. 1(a) and (b) shows the schematic of the DIGs. In Fig. 1(c) we see that the DIGS configuration could greatly enhance absorption by enabling high coupling efficiency to many guided modes.

Secondly, we show a light trapping strategy which combines front gratings with diffusers at the back. This strategy is aimed to enhance thin film cells with thickness beyond a few wavelengths and thus beyond the coherence length of sunlight. We demonstrate how the combined structure can outperform single element configurations. Fig. 2(a) shows the schematic of the combined structure. Fig. 2(b) shows the total reflectance for the combined structure as compared to single element configurations calculated under partial coherent conditions. It can be seen that the combined structure suppress the reflectance significantly better than the single element configurations. The effect of specular reflection and other geometrical parameters of the structure will be presented

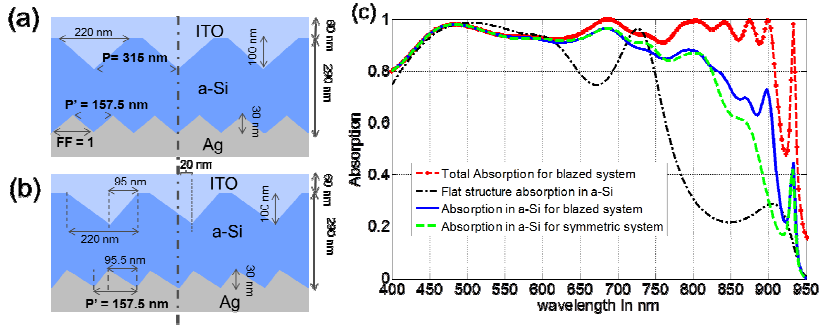

Fig. 1(a) Example symmetric dual periodic DIGS (b) Optimized blazed dual periodic DIGS. (c) Absorption spectrum of the structure in (a) and (b) along with a planar reference structure

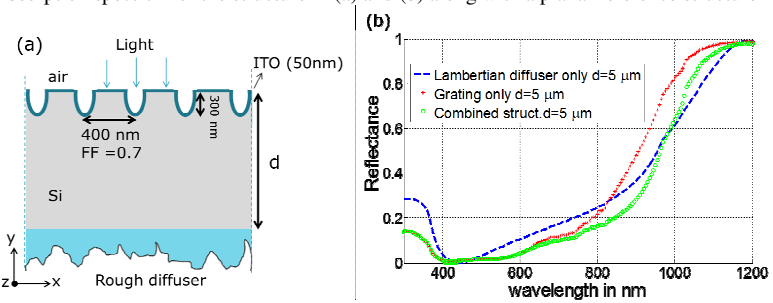

Fig. 2 (a) The combined front grating-back diffuser schematic. (b) Total reflectance of the combined structure compared with single element structures at two different thickness

Acknowledgements:

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References

[1] A. Abass, K.Q. Le, A. Alù, M. Burgelman, and B. Maes, *Phys. Rev. B.* **85**, 115449 (2012).