

Room E (107)

Session Title 27E2 / [T06] Novel Laser and Optical Technologies in Manufacturing
Date & Time Thursday, 27 August, 15:45 ~ 17:30
Session Chair Dongsik Kim (POSTECH, Korea)

[27E2-1] 15:45~16:15 Invited Talk

High Precision Prediction of Thin Film Composition by LIBS

Jung Hwan In, Chan Kyu Kim, Seok Hee Lee, and Sungho Jeong
GIST, Korea

The measurement of average composition or spatial elemental distribution in thin films of a few micrometer thickness is important for product evaluation or process monitoring in thin film product industry. This work reports that the average composition of thin solar cell films (~ 2 mm) could be predicted with high precision (< 1% relative standard deviation) by laser induced breakdown spectroscopy (LIBS). The depthwise distribution of constituent elements could also be measured with a spatial resolution below 100 nm as was confirmed with secondary ion mass spectrometry. It is discussed that the high precision of LIBS with its intrinsic rapid, no sample preparation, in-air measurement capability provides a powerful technique for composition monitoring at manufacturing sites.

[27E2-2] 16:15~16:30

Highly Stable Periodic Structures Using Nonlinear Laser Lithography

Özgün Yavuz¹, Ihor Pavlov¹, Onur Tokel¹, Emre Ergecer¹, Anil Ritzaoğlu¹, and F. Ömer Ilday^{1,2}

¹Bilkent University, Turkey, ²Middle East Technical University, Turkey
Nonlinear laser lithography (NLL) emerged as a novel surface structuring method allowing long range periodic order. We present mathematical formalism for NLL, analysis of structure stability to perturbations and a way to control final tiling patterns.

[27E2-3] 16:30~16:45

The Formation of Periodic Surface Structures on Ni-Fe Film Induced by Single Femtosecond Laser Pulse with Diffraction Rings

Kan Zhou, Tian Qing Jia, and Xin Jia
East China Normal University, China

We have observed the formation of periodic surface structures on Ni-Fe film irradiated by a single femtosecond laser pulse. We propose that this is due to the modulated transient permittivity and the surface plasmon.

[27E2-4] 16:45~17:00

Ultrafast Micromachining of Cu and Si at Ultra-high Repetition Rates with Pulse Bursts

Can Kerse¹, Hamit Kalaycıoğlu¹, Parviz Elahi¹, Koray Yavuz¹, Inam Mirza², Nadezhda M. Bulgakova^{2,3}, and F. Ömer Ilday¹

¹Bilkent University, Turkey, ²Institute of Physics, Czech Republic, ³Institute of Thermophysics, Russia
We report a novel ultrafast burst mode fiber laser system, which can deliver pulses at ultra-high repetition rates in order to systematically investigate micromachining efficiency on copper and silicon samples.

[27E2-5] 17:00~17:15

Hybrid Manufacturing of Stainless Steel and Zirconia Micro Components Using Laser Micromachining and Powder Injection Molding

Hyeseong Sin¹, Daehwan Ahn¹, Youngsam Kwon², and Dongsik Kim¹

¹POSTECH, Korea, ²CetaTech Co., Ltd., Korea
This work reports a hybrid manufacturing process for fabricating zirconia and SUS micro components using ns/fs laser micromachining and powder injection molding. Mechanisms of material removal and characteristics of the process were analyzed.

[27E2-6] 17:15~17:30

Femtosecond Laser Machining of Transparent Materials at High Speed and Quality

Frank Hendricks and V. Matyilsky
Spectra-Physics, Austria

We have developed and characterized ablative and nonablative femtosecond laser processes for precision machining of transparent materials. Ablation process is compared with a newly developed non-ablative patent pending femtosecond process, ClearShape™, using the Spectra-Physics® Spirit® industrial femtosecond laser.

Room F (108)

Session Title 27F2 / [T07] Optical Metrology and Sensing VIII
Date & Time Thursday, 27 August, 15:45 ~ 17:30
Session Chair Haiyong Gan (National Institute of Metrology, China)

[27F2-1] 15:45~16:00

Nondestructive Inspection of Fiberglass-Reinforced Plastic Mortar Pipes Using Electro-Optic Sensors and Microwave Propagation

Fumiaki Ueno¹, Yoshiyuki Azuma¹, Hiroshi Murata¹, Tadahiho Okuda², Masaya Hazama², and Yasuyuki Okamura¹

¹Osaka University, Japan, ²Kurimoto Ltd., Japan

A nondestructive measurement technique for fiberglass-reinforced plastic mortar pipes using electro-optic (EO) sensors and microwave propagation is proposed. The change in field distributions of microwave propagating along the pipes was verified clearly using EO sensors.

[27F2-2] 16:00~16:15

Two FBG Spectral Convolution for Strain Sensing

Shih-Hsiang Hsu, Kuo-Wei Chuang, and Ci-Syu Chen

National Taiwan University of Science and Technology, Taiwan

Two FBG spectral convolution was characterized using a delayed self-homodyne method for strain sensing. The strain sensitivity demonstrated 165-MHz/ $\mu\epsilon$ and sensing limitation could achieve $1-n\epsilon$ with 165 kHz bandwidth resolution in the electric spectrum analyzer.

[27F2-3] 16:15~16:30

Highly Sensitive Magnetic Field Sensor Using Long-Period Fiber Grating

Meng Ying Zhang¹, Xinyong Dong¹, Ping Shum¹, Juan Juan Hu², Haibin Su¹, Wen Siang Lew¹ and Lei Wei¹

¹Nanyang Technological University, Singapore, ²Agency for Science, Technology and Research, Singapore

We experimentally demonstrate a magnetic field sensor based on long-period fiber grating (LPG) and magnetic fluid. Our proposed sensor possesses a high sensitivity of ~0.154 dB/Gauss and a low measurement threshold of ~7.4 Gauss.

[27F2-4] 16:30~16:45

Self-Heterodyne Interference Spectroscopy Using Pseudo-Noise Modulation

Vincent Michaud-Belleau¹, Nicolas Bourbeau Hébert¹, James D. Anstie², André N. Luiten², and Jérôme Genest¹

¹Université Laval, Canada, ²University of Adelaide, Australia

A new spectroscopic technique that uses a single CW laser and pseudo-noise modulation provides an absorption spectrum having spectral point spacing of 40 MHz over a 2.5 GHz span in a single 1-ms measurement.

[27F2-5] 16:45~17:00

Irreversible Gold Nanospheres Adsorption on Optical Fiber Tapers and Microspheres

Jihaeng Yi

Dankook University, Korea

The surfaces consist of tapers and microspheres fibers and were coated with a polycation, enabling irreversible nanosphere adsorption. We compare the results with the theory that particle adsorption rates depend strongly on surface geometry.

[27F2-6] 17:00~17:15

Development of Ultrasound Sensor Using an SU-8 Polymer Based Fabry-Perot Interferometer

Hyunmin Yoon¹, Jeongmin Heo², Hyoungwon Baac², and Junseok Heo¹

¹Ajou University, Korea, ²Sungkyunkwan University, Korea

Ultrasound sensing was investigated with SU-8 polymer based Fabry-Perot interferometers consisting of TiO₂/SiO₂ distributed Bragg mirrors (DBRs). The DBRs are properly modified to transmit an excitation pulse laser (532 nm) generating ultrasound in all-optical transducers.

[27F2-7] 17:15~17:30

Sensitive Oxygen Detection Using Second Harmonic Generation of a Telecommunication Band Semiconductor Laser

Kazuo Maeda, Shunsuke Kuwabara, Ryutarō Yamashita, Ryuta Someya, Kazuyoku Tei, and Shigeru Yamaguchi

Tokai University, Japan

Tunable source employed a waveguide periodically poled LiNbO₃ with distributed-feedback diode laser was successfully demonstrated to measure the oxygen A band absorption lines. Developed spectrometer can detect trace oxygen as low as 10 ppm level.