PROGRAM (final)

The 4th Japan-China-Korea Joint Conference on MEMS/NEMS (JCK MEMS/NEMS 2013) August 22 - 24, 2013, CENTER HALL, Tohoku University

Thursday, August 22, 2013

11:30- Welcome Registration, Welcome drink

13:00-13:10 Opening Address; Prof. Eiji Higurashi, The University of Tokyo 13:10-14:30 Memorial Tutorial; Prof. Masayoshi Esashi, Tohoku University

14:30-15:00 Invited Talk 1 "Nanostructured Micromeshes"

Prof. Jong Soo Ko, Pusan National University

15:00-15:30 Break 15:30- Tour

Friday, August 23, 2013

8:45-14:30 Oral Presentation

Chair: Prof. Dong-Won Lee, Prof. Xueyong Wei				
8:45-9:00	Introduction of the Application of Wireless Laser Doppler Blood	Kei Nishihara, Wataru Iwasaki, Masaki Nakamura, Toshihiro	Kyushu University	
O-01	Flow Meter for the Measurement of Chicken Blood Flow	Itoh, Ryutaro Maeda, Renshi Sawada		
9:00-9:15	Three-dimensional integrated scaffold containing aligned	PARK Suk-Hee, YANG Dong-Yo, LEE Hye-Jin, LEE Nak-	KITECH	
O-02	nanofiber matrix for muscle tissue engineering	Kyu		
9:15-9:30	MEMS-IC integration for wireless sensor network applications	J.Lu, Y.Nakano, L.Zhang, H.Kuwabara, H.Takagi, R.Maeda	AIST	
O-03				
9:30-9:45	Collaboration magic between simulation-based engineers and	Akira Tezuka, Hitoshi Nitta, Yasuro Irie	AIST	
O-04	experiment-based researchers in BEANS project			
9:45-10:30		Café & Poster session		

	Chair: Dr. Nak-Kyu Lee, Prof. Kentaro Totsu		
10:30:10:45	Application of micro blood flowmeter to observe the	Wataru Iwasaki, Nogami Hirofumi, Renshi Sawada	AIST
O-05	physiological effects of alcohol injestion		
10:45-11:00	Supercritical Fluid Deposition and Characterization of Carbon	Zhonglie An, Masaya Toda, Takahito Ono	Tohoku university
O-06	Nanotubes-Cu Composite		
11:00-11:15	Transfer of thin film copper micro-electrodes to flexible PDMS	Ikjoo Byun, Anthony W. Coleman, Masaaki Ichiki,	The University of Tokyo
O-07		Beomjoon Kim	
11:15-11:30	Nanoprecision Alignment and Low-Temperature Bonding for	Chenxi Wang, Kihoon Jang, Yan Xu, Kazuma Mawatari,	The University of Tokyo
O-08	Multifunctional Nanofluidic Chips	Takehiko Kitamori	
11:30-11:45	Fabrication of Superhydrophobic Microstructured Surfaces using	J.M. Lee, K.K. Jung, J.S. Ko	Pusan National University
O-09	Cu-Ni electrodeposition		r usan National Oniversity
11:45-12:00	Suppression of Curvature in MEMS Membrane	Tomomi Sakata, Keita Yamaguchi, Naru Nemoto, Mitsuo	NTT Corporation
O-10		Usui, Kazuyoshi Ono, Kazuhiko Takagahara, Kei Kuwabara,	
		Yoshito Jin, and Hiroshi Koizumi	
12:00-13:00		Poster session	

	Chair: Prof. Haixia Zhang, Dr. Hye-Jin Lee		
13:00-13:15	Numerical and Experiment to Predict Die Shift in Compression	Si-Mo Yeon, Jeanho Park, Nak-Kyu Lee, Seogou Choi, Hye-	KITECH
O-11	Molding for Wafer Level Packaging	Jin Lee	
13:15-13:30	Electroless Copper Plating on Polyimide Substrate with	Sang-Cheon Park, Kenta Suzuki, Junho Choi, Takahisa Kato,	AIST
O-12	Submicron Pattern Modified by UV Irradiation	Sung-Won Youn, Hideki Takagi, Hiroshi Hiroshima, Ryutaro	
13:30-13:45	Bulk Acoustic Mode Resonators: Design, Characterization and	Xueyong Wei and Ashwin Seshia	Xi'An Jiaotong University
O-13	Application		
13:45-14:00	Monolithic Integration of Film Bulk Acoustic Wave Resonator on	Abhay Kochhar, Masayoshi Esashi, Shuji Tanaka	Tohoku university
O-14	CMOS Circuit		
14:00-14:15	Flexible Thermoelectric Power Generator Combined with Cu	Sihuang Zhao, Yusuke Kawai and Takahito Ono	Tohoku University
O-15	Thermal Guides Array		
14:15-14:30	Tuner integrated resonant micro mirror scanner for compensation	Yusuke Kawai and Takahito Ono	Tohoku university
O-16	of non-liner spring effect		

14:30- to Akyu, Hotel IWANUMAYA

18:30- Banquet

Saturday, August 24, 2013

9:30-10:00 Invited Talk 2 "A novel method to improve the performance of a mechanical nano-sensor"

Prof. Zhanoying Zhou, Tsinghua University

10:00-12:15 Oral Presentation

	Chair: Prof. Shuji Tanaka		
10:00-10:15	Development of High-Accuracy and Non-Contact Current Sensor	Shinya Mito, Kazuma Takenaka, Satoshi Kato	NMEMS Technology
O-17			Research Organization
10:15-10:30	CO2 Gas Sensor using Ionic-Liquid Gel	Masahito Honda, Toshihiro Itoh, Ryutaro Maeda	NMEMS Technology
O-18			Research Organization
10:30-10:45		Café	
10:45-11:00	An AlN cantilever for air differential pressure detection with high	Y. Kaiho, H. Takahashi, Y. Tomimatsu, T. Kobayashi, K.	NMEMS Technology
O-19	sensitivity	Matsumoto, I. Shimoyama, T. Itoh, R. Maeda	Research Organization
	Chair: Prof. Niancai Pen, Prof. Yoshiaki Kanamori		
11:00-11:15	Relation between Q-factor and resonance mode of polymer	N. Shiraishi, M. Kimura, Y. Ando	NMEMS Technology

	in a second				
	Chair: Prof. Niancai Pen, Prof. Yoshiaki Kanamori				
11:00-11:15	Relation between Q-factor and resonance mode of polymer	N. Shiraishi, M. Kimura, Y. Ando	NMEMS Technology		
O-20	cantilevers		Research Organization		
11:15-11:30	A windmill-structured electromagnetic energy harvester	Xuan Wu, Mitesh Parmar, Dong-weon Lee	Chonnam National University		
O-21					
11:30-11:45	Surface-micromachined Planar Piezoresistive Vibration Sensor	Lan Zhang, Jian Lu, Hideki Takagi, Ryutaro Maeda	AIST		
O-22					
11:45-12:00	Development of Piezoelectric MEMS Devices	T. Kobayashi, N. Makimoto, Y. Suzuki, H. Okada, H.	AIST		
O-23		Nogami, Hiroshi Funakubo, S. Oyama, T. Uriu, N. Moriwaki,			
		Y. Tomimatsu, T. Itoh, R. Maeda			
12:00-12:15	Development of MEMS Viscosity Sensor with Dual Spiral	Y. Yamamoto, S. Matsumoto, T. Yamamoto, S. Choi, M.	AIST		
O-24	Vibrating Beams	Kuroda, H. Yabuno			
11:45-12:00 O-23 12:00-12:15	Development of MEMS Viscosity Sensor with Dual Spiral	Nogami, Hiroshi Funakubo, S. Oyama, T. Uriu, N. Moriwaki, Y. Tomimatsu, T. Itoh, R. Maeda Y. Yamamoto, S. Matsumoto, T. Yamamoto, S. Choi, M.			

13:00-15:30 Tour

Poster Presentation

Friday, August 23, 2013

Name	P-01	Pico-calorimeter using a resonant thermal sensor	Naoki Inomata, Takahito Ono	Tohoku university
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The Novel structural Design for micro-spessure seroors Polif Polif The Tour Imaging aung Temperature Sensive France for High Speed Thermal Phenomena at Microscale Polif The Novel Structure The Novel Phenomena at Microscale Polif The Novel Structure The Novel Phenomena at Microscale Polif Schedaly Glob Lyte Indiana The Novel Phenomena at Microscale Polif Schedaly Glob Lyte Indiana The Novel Phenomena Polif Particulate of High Delectric Consum Capacitees Forbedded in Path Polify Polify Microscale Minimal Research Polif Transfer of PZT Im film capacitor using controlled spalling Polif Transfer of PZT Im film capacitor using controlled spalling Polif Transfer of PZT Im film capacitor using controlled spalling Polif Schooleavy The Minimal Phenomena Polif Transfer of PZT Im film capacitor using controlled spalling Polif Schooleavy The Minimal Phenomena Polif Schooleavy The Minim	P-03			Xi'an Jiaotong University
Thermal Intensing using Temperature Sensitive Paint for High Sport Thermal Processing and Microscale and Micros	P-04	The Novel structural Design for micro-pressure sensors	2 0	Xi'an Jiaotong University
Sciontity diode type hydrogen seasor on GaN onnoertwork	P-05	Thermal Imaging using Temperature Sensitive Paint for High		
P408 A 20m free Spectra Range Optical Filter Based on NUM- P108 Page 12 miles (Silicon Pilatonic Waveguida Miero-Ring Resonator Page 12 miles (Silicon Pilatonic Waveguida Miero-Ring) (Silicon Pilatonic Waveguida Miero-Ring) (Silicon Ravia, Elgi Higarashi, Tadatono Suga, Masaki The University of Takina, Sangara Patheriasion of a large Stroke Continuous Membrana Deformable Minror Ravia (Silicon Ravia, Elgi Higarashi, Tadatono Suga, Renshi Page 12 miles (Silicon Pilatonic Waveguida Miero-Ring) (Silicon Ravia, Elgi Higarashi, Tadatono Suga, Renshi Page 14 miles (Silicon Pilatonic Waveguida Waveguida Miero-Ring) (Silicon Ravia, Elgi Higarashi, Tadatono Suga, Renshi Page 14 miles (Silicon Pilatonic Waveguida Waveguida Miero-Ring) (Silicon Ravia, Elgi Higarashi, Tadatono Suga, Pendanican Suga, Sanga and Pakire) (Silicon Silicon of Suga Pendanican Osuface Warnahiliy by measo of the Masaureneut of the Adhesive Force between a Microatructured Hybriophobic Solitonic of Adhesive Force between a Microatructured Hybriophobic Solitonic of Suga, Sanga-Page (Silicon of Suga, Sanga-Page 12 miles (Silicon of Suga, Sanga-Page 12 m	P-06		Khademhosseini, Masaharu Takahashi, Akihiro Makino,	Tohoku university
Paushe Silicon Promotic Wasseguide Micro Ring Reconstor Paushe Stricture of Profit in filteration of High Dielectric Constant Capacitors Embedded in Plexible Polymer by Molecular Cilia P-10 Trusted or FZT bin filtin capacitors using controlled spalling rechnology P-11 Low-temperature solid-strate solder bonding process using hydrogen radical for MEMS packaging application P-12 Low-temperature solid-strate solder bonding process using hydrogen radical for MEMS packaging application P-13 Storog light coupling between heavergenessure plasma activation for optical micro-series. P-14 Storog light coupling between heavergenessure plasma activation for optical micro-series. P-15 Storog light coupling between heavergenessure plasma activation for optical micro-series. P-16 Swalanian activation for optical micro-series. P-17 Storog light coupling between heavergenessure of the Adhesive Force between a Microstructured Hydrophobic Surface and a Water Drugblet P-16 Swalanian of Surface withouthing by means of the Measurement of the Adhesive Force between a Microstructured Hydrophobic Surface and a Water Drugblet P-17 Low temperature GaA-SiC wafer bonding for high-power semicondators lasers of the Adhesive Force between a Microstructured Hydrophobic Surface and a Water Drugblet P-18 Mechanical Properties Evaluation of Cu-TSVSpecimen P-19 MEMS-turable optical switches based on multiple ring resonators of P0-22 Tilo 3 Thin Filin Devices on 200 mm SOI Wafer P-20 Inspirate Distriction of Microstructure Array using Austoroptic Wet P-21 Inspiration of Microstructure Array using Austoroptic Wet P-22 Research to 2 dimensional structure using three beam interfence Fisching P-23 The Development of Hange Bylanting Using Nano- Phase P-24 Research to 2 dimensional structure using three beam interfence Fisching P-25 Application of Nano-imprint to simultuneous forming of Fisching Surface research for delectorophoresis chip P-26 More Adhesive Surface Properties and a large MMP-2 and MMP-7 MMP-2 and MMP-7 MMP-2 and MMP-7 MMP-2 and MMP-7 MMP	P-07	Schottky diode type hydrogen sensor on GaN nanonetwork		Tohoku University
Poblic Policy Polymer by Molecular Cline Pacific Polymer by Molecular Cline Polymer of Polymer by Polymer Cline Polymer of Polymer by Polymer by Molecular Cline Polymer of Polymer of Manage Biometer of Polymer by Molecular Cline Polymer of Polymer of Manage Biometer of Polymer by Molecular Cline Polymer of Polymer of Manage Biometer of Reference o	P-08		Hoang Manh Chu, Takashi Sasaki, Kazuhiro Hane	Tohoku university
Parameter of PCT thin film capacitor using controlled spalling Environment Enhity, Toolshin Tools The University of T	P-09	Fabrication of High Dielectric Constant Capacitors Embedded in	Yuki Amano, Ikjoo Byun, Masaaki Ichiki, BeomJoon Kim	The University of Tokyo
P-12 Low-semperature solid-state solder bonding process using Northean radiation for MERS peakaging application Michislas Yanamoto, Egi Higurashi, Tadatomo Suga, Renshi Sanada carizon for origidal micro-sensors Sanada ancilvation for origidal micro-sensors Sanada activation for origidal micro-sensors Sanada Sana	P-10	Transfer of PZT thin film capacitor using controlled spalling		The University of Tokyo
Part	P-11	Low-temperature solid-state solder bonding process using		The University of Tokyo
Borrison Flught coupling between betreogeneous nanophotonic circuit using a frate-guided-mode photonic crystal waveguide	P-12	Low-temperature Au-Au bonding using atmospheric-pressure		The University of Tokyo
P-14 Electrical characteristics of directly-bonded p-Ge-nt-Si interfaces Surface and a Water Droplet P-15 Electrical characteristics of directly-bonded p-Ge-nt-Si interfaces Surface and a Water Droplet Surface and a Water Droplet P-16 Evaluation of Surface Wettability by means of the Massurment of the Adhesive Force between a Microstructured Hydrophobic Surface and a Water Droplet P-17 Low temperature GRASSIC wafer bonding for high-power semiconductor lasers Mechanical Properties Evaluation of Cu-TSVSpecimen P-18 Membranian Droperties Evaluation of Cu-TSVSpecimen P-19 MEMS-tunable optical switches based on multiple ring resonators of PbCZr,Ti)O3 Thin Film Devices on 200 mm SOI Wafer P-20 In-plane Distribution of Piezoelectric and Ferroelectric Properties of PbCZr,Ti)O3 Thin Film Devices on 200 mm SOI Wafer P-21 Electrode thickness control by ink-jet printing with selective Surface Internation of Microstructure Array using Anisotropic Wet Behring P-22 Electrode thickness control by ink-jet printing with selective Surface Internation of Microstructure Array using Anisotropic Wet Behring P-23 The Development of High Functional Alloy Plating Using Nano- Phase P-24 Research on 2-dimensional structure using three beam interface initions of Nano-imprint to simultaneous forming of concentric minitaure concentre m	P-13	Strong light coupling between heterogeneous nanophotonic	Borriboon Thubthimthong, Yuta Hayakawa, Takashi Sasaki,	Tohoku university
February	P-14	Design and Fabrication of a Large Stroke Continuous Membrane	Tong Wu , Takashi Sasaki, Masayuki Akiyama, Kazuhiro	Tohoku university
of the Adhesive Force between a Microstructured Hydrophobic Surface and Ja Water Droplet P-17 Low temperature GaAs/SiC wafer bonding for high-power semiconductor lasers Hong Wang, Ting Gu, Zhaoyu Wang, Huiying Wang, Ping Cheng, Zhaoyu Wang, Huiying Wang, Ping Cheng, Zhaoying Wang, Chiru Ding Cheng, Zhaoying Wang, Chiru Ding Cheng, Zhaoying Wang, Ping Cheng, Zhaoying Wang, Chiru Ding Cheng, Zhaoying Wang, Ping Cheng, Zhaoying Wang, Chiru Ding Cheng, Zhaoying Wang, Ping Cheng, Zhaoying Wang, Chiru Ding Cheng, Zhaoying Wang, Chiru Ding, Cheng, Zhaoying Wang, Chiru Ding, Cheng, Zhao, Wang, Ping Cheng, Zhao, Ping Cheng, Zhao, Ping Cheng, Zhao, Ping Cheng, Zhao, Wang, Ping Cheng, Zhao, Ping Cheng,	P-15			The University of Tokyo
P-18 Mechanical Properties Evaluation of Cu-TSVSpecimen Hong Wang, Ting Gu, Zhaoyu Wang, Huiying Wang, Ping Cheng, Zhuoqing Yang, Guifu Ding Cheng, Zhuoqing Yang, Sangh Manda Zhang Markati Cheng, Zhuoqing Yang, Sangh Manda Xin Lix Andria Cheng, Yang, Sangh Markati Cheng, Yang, Sangh Markati Cheng, Yang, Sangh Markati Cheng, Yang, Sangh Yang, Yang, Sang	P-16	of the Adhesive Force between a Microstructured Hydrophobic	Kyung Kuk Jung, Seung-hwan Lee, and Jong Soo Ko	Pusan National University
P-19	P-17	Low temperature GaAs/SiC wafer bonding for high-power	H. Narusawa, K. Nakasuji, E. Higurashi, T. Suga	The University of Tokyo
MEMS-tunable optical switches based on multiple ring resonators Xin Li, Zheng Shi, Shumin He, Xumin Gao, Miao Zhang, Nanjing University one of PtdCx, Ti/O3 Thin Film Devices on 200 mm SOI Wafer Nobuyoshi Moriwaki, Takeshi Kobayashi, Yasuhiro Suzuki, NMEMS Technology Natural Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro Research Organizat fubi, Rwutami Makimoto, Koji Fubinoto, Kosuke Suzuki, Toshihiro Rutami Makimoto, Koji Fubinoto, Rwutami Makimoto,	P-18	Mechanical Properties Evaluation of Cu-TSVSpecimen		Shanghai Jiao Tong University
In-plane Distribution of Piezoelectric and Ferroelectric Properties of Pb(Zr, Ti)O3 Thin Film Devices on 200 mm SOI Wafer	P-19	MEMS-tunable optical switches based on multiple ring resonators	Xin Li, Zheng Shi, Shumin He, Xumin Gao, Miao Zhang,	Nanjing University of Posts
Etching	P-20		Nobuyoshi Moriwaki, Takeshi Kobayashi, Yasuhiro Suzuki, Natsumi Makimoto, Koji Fujimoto, Kosuke Suzuki, Toshihiro	NMEMS Technology
P-22 Electrode thickness control by ink-jet printing with selective surface treatment for dielectrophoresis chip P-23 The Development of High Functional Alloy Plating Using Nano-Phase P-24 Reserach on 2-dimensional structrure using three beam interfence lithography P-25 Application of Nano-imprint to simultaneous forming of concentric miniature concavo-convex patterns and a large through-hole with high accuracy P-26 Study on Electrochemical sensor for detection of biofilm P-27 Micro/Nano Manufacturing and Its Applications via Inter-University Networking between Universities and AIST - Under One Roof Report - Part 2 P-28 A biochip for diagnosing ovarian and colorectal cancer using MMP-2 and MMP-7 P-29 Study on serial stack structure for improving maximum power energy of Microfluidic fuel cell P-30 Development of Nanogap Biosensor for Cervical Cancer by HPV P-31 HIGH-THROUGHPUT AND LOW-COST FABRICATION OF POLYMER MICROSCANNER FOR LIGHTING APPLICATIONS P-32 Surface activated room-temperature direct bonding of Au electroplated patterns for heterogeneous integration of MEMS P-33 Introduction of the "Integrated Microsystems" project Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) P-34 Room temperatures and alroy with the program of the "Integrated Microsystems" project Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) P-35 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures	P-21		Sunao Murakami, Seigi Shimizu, Takahiro Ito	1 -
P-23	P-22			KITECH
P-24 Reserach on 2-dimensional structrure using three beam interfence lithography P-25 Application of Nano-imprint to simultaneous forming of concentric miniature concavo-convex patterns and a large through-hole with high accuracy P-26 Study on Electrochemical sensor for detection of biofilm Byeong-Jun Hwang, Jong-Soo Ko, Sung-Ho Lee KITECH P-27 Micro/Nano Manufacturing and Its Applications via Inter-University Networking between Universities and AIST - Under One Roof Report - Part 2 P-28 A biochip for diagnosing ovarian and colorectal cancer using MMP-2 and MMP-7 P-29 Study on serial stack structure for improving maximum power energy of Microfluidic fuel cell P-30 Development of Nanogap Biosensor for Cervical Cancer by HPV P-31 HIGH-THROUGHPUT AND LOW-COST FABRICATION OF POL-YMER MICROSCANNER FOR LIGHTING APPLICATIONS P-32 Surface activated room-temperature direct bonding of Au electroplated patterns for heterogeneous integration of MEMS P-33 Introduction of the "Integrated Microsystems" project Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) P-34 Room temperature wafer direct bonding using Si wafers smoothed by Ne beam surface treatments P-35 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures P-36 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures P-37 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures P-38 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures P-39 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures P-30 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures P-30 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures	P-23	The Development of High Functional Alloy Plating Using Nano-	Jeon Mo Choi, Joon Kyun Lee	KITECH
P-25 Application of Nano-imprint to simultaneous forming of concentric miniature concavo-convex patterns and a large through-hole with high accuracy P-26 Study on Electrochemical sensor for detection of biofilm P-27 Micro/Nano Manufacturing and Its Applications via Inter-University Networking between Universities and AIST - Under One Roof Report - Part 2 P-28 A biochip for diagnosing ovarian and colorectal cancer using MMP-2 and MMP-7 Study on serial stack structure for improving maximum power energy of Microfluidic fuel cell P-30 Development of Nanogap Biosensor for Cervical Cancer by HPV HIGH-THROUGHPUT AND LOW-COST FABRICATION OF POLYMER MICROSCANNER FOR LIGHTING APPLICATIONS P-32 Surface activated room-temperature direct bonding of Au electroplated patterns for heterogeneous integration of MEMS P-34 Room temperature wafer direct bonding using Si wafers smoothed by Ne beam surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures Application of Nanogan Horna and a large Miyazaki, Renshi Sawada Byeong-Jun Hwang, Jong-Soo Ko, Sung-Ho Lee KITECH Dong F. Wang, Ryutaro Maeda Ibaraki University Miyazaki, Renshi Sawada Wiyazaki, Renshi Sawada Ibaraki University Miyazaki, Renshi Sawada Ibaraki University Miyazaki, Renshi Sawada Ibaraki University Pwang, Ryutaro Maeda Wong F. Wang, Ryutaro Maeda Wong Lee, Jun MO Han, Je Sik Jeong, Seong Yong Lee, Jun MO Han, Je Sik Jeong, Seong Yong Lee, Jun MO Han, Je Sik Jeong, Mang, Yoo min Ahn Hanyang University Won Ick Jang, Han Young Yu, Yarkyeon Kim, Jeong Hyun Hanyo Maeda Haruy Han, Yongon-Sik Eum Haruy Han Young Yu, Yarkyeon Kim, Jeong Hyun Hanyo Maeda Yuichi Kurashima, Atsuhiko Maeda, Hideki Takagi Yuri Kitajima, Yuichi Ishikawa, Ryutaro Maeda Yuri Kitajima, Yuichi Ishikawa, Ryutaro Maeda	P-24	Reserach on 2-dimensional structrure using three beam interfence	Jeong-Il Gyu, Jong-Seok Kim, Sung-Ho Lee	KITECH
P-26 Study on Electrochemical sensor for detection of biofilm Byeong-Jun Hwang, Jong-Soo Ko, Sung-Ho Lee KITECH	P-25	Application of Nano-imprint to simultaneous forming of concentric miniature concavo-convex patterns and a large		Kyushu University
University Networking between Universities and AIST - Under One Roof Report – Part 2 P-28 A biochip for diagnosing ovarian and colorectal cancer using MMP-2 and MMP-7 P-29 Study on serial stack structure for improving maximum power energy of Microfluidic fuel cell P-30 Development of Nanogap Biosensor for Cervical Cancer by HPV energy of Microfluidic fuel cell P-31 HIGH-THROUGHPUT AND LOW-COST FABRICATION OF POLYMER MICROSCANNER FOR LIGHTING APPLICATIONS P-32 Surface activated room-temperature direct bonding of Au electroplated patterns for heterogeneous integration of MEMS P-33 Introduction of the "Integrated Microsystems" project Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) P-34 Room temperature wafer direct bonding using Si wafers smoothed by Ne beam surface treatments P-35 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures In Jae Seo, Seung Yong Lee, Jun MO Han, Je Sik Jeong, Seung Yong Hwang, Yoo min Ahn Hanyang University Won Lck Jang, Han Young Yu, Yarkyeon Kim, Jeong Hyun Han, Nyeon-Sik Eum Hanyang University Won Ick Jang, Han Young Yu, Yarkyeon Kim, Jeong Hyun Han, Nyeon-Sik Eum Haruyon Hashimoto, Kazuma Kurihara, Hideki Takagi, Ryutaro Maeda Yuichi Kurashima, Atsuhiko Maeda, Hideki Takagi Yuri Kitajima, Yuichi Ishikawa, Ryutaro Maeda AIST AIST AIST AIST P-34 Atsuhiko Maeda, Yuichi Kurashima, Hideki Takagi The University of Takaging Huriyang Aisuhiko Maeda, Ying-Hui Wang, TadatomoSuga The University of Takaging Aisuhiko Maeda, Ying-Hui Wang, TadatomoSuga	P-26		Byeong-Jun Hwang, Jong-Soo Ko, Sung-Ho Lee	KITECH
P-28 A biochip for diagnosing ovarian and colorectal cancer using MMP-2 and MMP-7 P-29 Study on serial stack structure for improving maximum power energy of Microfluidic fuel cell P-30 Development of Nanogap Biosensor for Cervical Cancer by HPV Han, Nyeon-Sik Eum P-31 HIGH-THROUGHPUT AND LOW-COST FABRICATION OF POLYMER MICROSCANNER FOR LIGHTING APPLICATIONS P-32 Surface activated room-temperature direct bonding of Au electroplated patterns for heterogeneous integration of MEMS P-33 Introduction of the "Integrated Microsystems" project Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) P-34 Room temperature wafer direct bonding using Si wafers smoothed by Ne beam surface treatments P-35 Influence of Surface Pre-Pretreatment on Si Wafer Bonding at Low Temperatures In Jae Seo, Seung Yong Lee, Jun MO Han, Je Sik Jeong, Seung Yong Hanyang University Seung Yong Hwang, Yoo min Ahn Hanyang University Seung Hanyang University	P-27	University Networking between Universities and AIST - Under	Dong F. Wang, Ryutaro Maeda	Ibaraki University
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Applications Lee	P-36	Pressure-Controlled Variable Resistor for Limit Switch		Chonnam National University

A Windmill-structured Electromagnetic Energy Harvester

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ABSTRACT

In this paper, we introduce a novel electromagnetic energy harvester with windmill-structure for low-power autonomous sensors. This design of the proposed energy harvester can effectively scavenge the energy from wind source based on the electromagnetic phenomenon. The windmill structure with four magnets can rotate in a high speed under wind excitation and thereby generate power efficiently through the coils nearby. A miniature energy harvester prototype is fabricated using 3D printing technique. In the performance testing experiment, a peak current of 299 mA and a peak output power of 418 mW are achieved within a high rotating speed range up to 4260 rpm. Moreover, a maximum V_{rms} of 117 mV is obtained on a driving car with a speed of 40 km/h, which could be potential power supply for wireless sensors network application.

Keywords: Energy harvesting, Electromagnetic, Windmill-structure, Wireless sensors network (WSN)

1. INTRODUCTION

In recent years, wireless sensors network (WSN) has been regarded as one of the most significant technologies in 21st century [1]. Unfortunately, the limited power of batteries in WSN applications will result in large amount of maintenance cost and mounting constrains [2]. Therefore, we propose a windmill-structured electromagnetic energy harvester to power the sensors in remote and harsh environment.

2. DESIGN AND EXPERIMENT

As shown in Fig. 1, during to the excitation caused by wind flow, the windmill structure will rotate and as a result, four end-magnets pass near the coils by turns. This structure can efficiently convert the wind energy into electricity. A prototype is fabricated utilizing 3D printing technology, which is shown in Fig. 2. The performance characterization is carried out in the experiment. It can be seen from Fig. 3 (a) and (b) that various pressures are applied on the energy harvester to test its output. With various applied pressure, a high rotating speed of 4260 rpm can be reached. Meanwhile, a peak output current of 299 mA and a peak output power of 418 mW are achieved, which are shown in Fig. 4-6. Additionally, as Fig. 7 and Fig. 8 shows, a maximum V_{rms} of 117 mV is obtained on a driving car with a speed of 40 km/h.

3. CONCLUSION

In this paper, we have presented the design, fabrication and characterization of an electromagnetic windmill-structured energy harvester which can effectively generate power under wind excitation. A maximum power of 418 mW is achieved, which fulfills the requirement of low-power autonomous sensors.

ACKNOWLEDGEMENT

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FIGURES

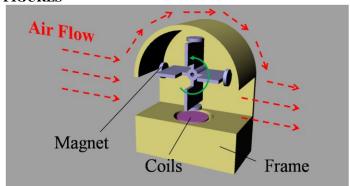


Fig. 1 The schematic of a windmill-structured energy harvester.

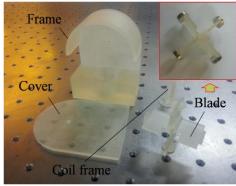


Fig. 2 The prototype of energy harvester fabricated by 3D printing technology.

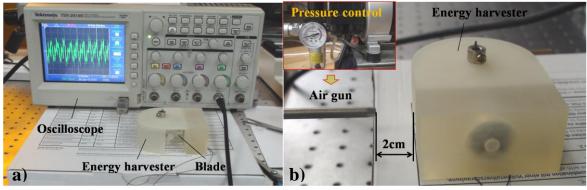


Fig. 3 Experiment setup: a) Utilizing the oscilloscope to test the output. b) Utilizing the air gun to apply pressure on the blades of energy harvester.

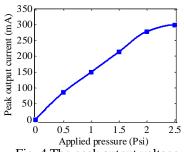


Fig. 4 The peak output voltage versus applied pressure.

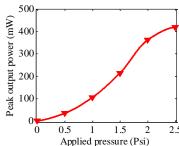


Fig. 5 The peak output power versus applied pressure.

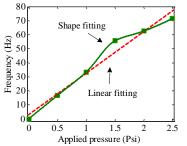


Fig. 6 The output frequency versus applied pressure.



Fig. 7 The output V_{rms} could be measured by a multimeter during car's driving.

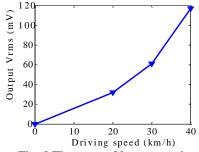


Fig. 8 The output V_{rms} versus the driving speed of a car.