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8P-7-81 Development of Fiber Coupling Thermal Microscope for Measuring Thermal Property in Micro-Scale Aarea S. Miyake 1, K. Hattori 2, T. Otsuki 2 and M. Sekine 2, 1 Kobe City College of Technol. and 2 Bethel, Japan	**8P-7-82** A Novel Joining Technique for Aluminum Foils by Using Al/Ni Exothermic Materials as Saving Heat Source T. Izumi 1, N. Kametani 1, S. Miyake 1, S. Kanetsuki 2 and T. Namazu 2, 1 Kobe City of College of Technol. and 2 Aichi Inst. of Technol., Japan	**8P-7-83** Fabrication and Application of Double-Side Notched Long Period Fiber Grating for Force Sensing Y.-L. Fang 1, T.-H. Huang 1, C.-W. Wu 2 and C.-C. Chiang 1, 1 Natl. Kaohsiung Univ. of Applied Sci. and 2 Air Force Academy, Taiwan	**8P-7-84** Bidirectional Hysteresis in Frequency Response of Arrayed Electrostatic MEMS Resonator T. Tsuchiya, Y. Matsui, Y. Hirai and O. Tabata, Kyoto Univ., Japan
8P-7-98L Profile Characterization and Temperature Effect on Wettability of Microstructured Surfaces Y. Han 1, Y. Liu 2, M. Takato 1 and F. Uchikoba 1, 1 Nihon Univ. and 2 Xi'an Univ. of Technol., China	**8P-7-99L** Photo-Induced Manipulation of Microspheres in PEG Solutions on Au Nanoisland Films N. Chishiro, K. Namura and M. Suzuki, Kyoto Univ., Japan	**8P-7-100L** Effect of Laser Irradiation Conditions on a Water Vapor Microbubble and Thermoplasmonic Marangoni Flow in Degassed Water S. Imafuku, K. Namura and M. Suzuki, Kyoto Univ., Japan	**8P-7-101L** High Temperature Wettability on Microstructrured Superhydrophobic Surface Y. Liu 1 and Y. Han 2, 1 Xi'an Univ., China and 2 Nihon Univ., Japan
8P-7-102L The Impact of Damping on Aluminum Nitride Piezoelectric MEMS Resonant Sensors S.I. Jung, C. Ryu and H.J. Kim, Gyeongbuk Inst. of Sci. and Technol., Korea	**8P-7-103L** Modeling of Multi-Mode Piezoelectric Cantilever Sensors for Liquid Property Analysis C. Ryu, S.I. Jung and H.J. Kim, Daegu Gyeongbuk Inst. of Sci. and Technol., Korea	**8P-7-104L** Polyurethane-Acrylate (PUA) Based Hydrophobic Film: Facile Fabrication, Characterization and Application J. Park, C.R. Yu, A. Shanmugasundaram and D.-W. Lee, Chonnam Natl. Univ., Korea	**8P-7-105L** A Parallel-kinematic Piezo-Driven Scanner for Improving Scan Speed of a Commercial Atomic Force Microscope B.O. Alunda 1, Y.J. Lee 1 and S. Park 2, 1 Kyungpook Natl. Univ. and 2 Keimyung Univ., Korea
8P-7-106L A Novel Tri-Axis MEMS Accelerometer with a Single Au Proof Mass and Fully Differential Sensing Electrodes H. Niijima 1,3, M. Takayasu 1,3, D. Yamane 1,3, T. Konishi 1,2,3, T. Safu 2, H. Ito 1,3, S. Dosho 1,3, N. Ishihara 1,3, K. Machida 1,3 and K. Masu 1,3, 1 Tokyo Inst. of Technol., 2 NTT-AT and 3 JST-CREST, Japan	**8P-7-107L** Micro Sample Chamber by laminated Fluorinated Films for NMR Spectroscopy of a Micro-Volume Spherical Sample T. Hizawa, M. Takahasi 2 and E. Iwase 1, 1 Waseda Univ. and 2 RIKEN, Japan	**8P-7-108L** Measurement of Conformability and Adhesion Energy of Ultrathin Film to Skin Model J. Sugano, T. Fujie 1,2, H. Iwata 1 and E. Iwase 1, 1 Waseda Univ. and 2 JST-PRESTO, Japan	**8P-7-109L** Effect of Heater Geometry on the Sensitivity of a Thermal Convection-Based Tilt Sensor J.K. Kim 1 , J.H. Kim 1,S.Y. Kwon 2, J.Y. Lee 2, D.G. Jung 2, S.H. Kong 2 and D. Jung 1, 1 KITECH and 2 Kyungpook Natl. Univ., Korea
8P-7-110L High Sensitive Flexible Capacitive Pressure Sensor Based on a Three-Dimensional PDMS/Microsphere Sponge Y. Jung 1,2, K.K. Jung 2,3, J.S. Ko 2 and H.C. Cho 1, 1 KITECH, 2 Pusan Natl. Univ. and 3 KOMERI, Korea	**8P-7-111L** Optimal Design for a High-Frequency Plano-Convex Quartz Resonator J. Ji 1, M. Zhao 1, H. Ohigawa 2 and T. Ueda 2, 1 Xidian Univ., China and 2 Waseda Univ., Japan	**8P-7-112L** Room-Temperature Bonding of $LiNbO_3$ and SiO_2 Using Surface Activated Bonding R. Takigawa, E. Higurashi and T. Asano, Kyushu Univ., Japan	**8P-7-113L** Designing Ferromagnetic Shield Geometry with Magnetic Field Simulation to Improve Target Utilizaiton on DC Magnetron Sputtering S.-H. Jang 1, S.-J. Park 1, K.-Y. Lee 2 and Y.-J. Kim 1, 1 Yonsei Univ. and 2 Samsung Display, Korea
Room A → Room B (Ramada Ballroom 2, 2F)	Room B → Room C (Ramada Ballroom 3, 2F)	Room C → Room D (Ramada Ballroom 4, 2F)	Room D → Room E (Seminar Room, 2F)
8A-8: 2D Nanodevices (15:40-17:50) Chairs: C.-H. Lee (Korea Univ.)	**8B-8: Nanfabrication II (15:40-17:50)** Chairs: G.H. Kim (KIMM) S. Shingubara (Kansai Univ.)	**8C-8: Electron and Ion Beam Technologies (15:40-18:10)** Chairs: D. Jang (Seoul Natl. Univ.) H.S. Kim (Sun Moon Univ.)	**8D-8: Nano Tool (15:40-18:00)** Chairs: K. Sugano (Kobe Univ.) J. Lee (Sogang Univ.)
8A-8-1 15:40 Light-Emitting Devices Based on Two-Dimensional van der Waals Materials (Invited) Y.D. Kim 1,2, T. Taniguchi 3, K. Watanabe 3, T.F. Heinz 4, D. Englund 5 and J. Hone 2, 1 Kyung Hee Univ., Korea, 2 Columbia Univ., USA, 3 NIMS, Japan, 4 Stanford Univ. and 5 MIT, USA	**8B-8-1** 15:40 Scalable Nanoarchitecturing Via Hybrid Nanoassembly and Continuous Nanopatterning (Invited) J.G. Ok, Seoul Natl. Univ. of Sci. and Technol., Korea	**8C-8-1** 15:40 Ultrafast Electron Microscopy: Principle and Applications (Invited) O.-H. Kwon, UNIST, Korea	**8D-8-1** 15:40 Unconventional Micro-/Nanofabrication Materials and Processes (Invited) J. Lee, B. Lee, J. Ko and Y. Yoon, Sogang Univ., Korea
8A-8-2 16:10 Tunneling Photocurrent Assisted by Interlayer Excitons in Staggered van der Waals Heterobilayers D.H. Luong, H.S. Lee, G.P. Neupane, S. Roy, G. Ghimire, J.H. Lee, Q.A. Vu and Y.H. Lee, Sungkyunkwan Univ., Korea	**8B-8-2** 16:10 Micro Patterned Powder Metallurgy Technique for SOFC Electrolyte Using UV Curable Resin T. Okabe 1, Y. Kim 2. Z. Jiao 2, N. Shikazono 2 and J. Taniguchi 1, 1 Tokyyo Univ. of Sci. and 2 Univ. of Tokyo, Japan	**8C-8-2** 16:10 (Invited) Y.-S. Hwang, Seoul Natl. Univ., Korea	**8D-8-2** 16:10 (Invited) M.K. Kwak, Kyungpook Natl. Univ., Korea

POLYURETHANE-ACRYLATE (PUA) BASED HYDROPHOBIC FILM: FACILE FABRICATION, CHARACTERIZATION AND APPLICATION

Jongsung Park[1], Chae Rin Yu[1], Arunkumar Shanmugasundaram, and Dong-Weon Lee[1]
[1] Department of Mechanical Engineering, Chonnam National University, Bukgu, Gwangju, Korea
E-mail: mems@jnu.ac.kr

1. INTRODUCTION

Herein, a facile and cost-effective method for the mass production of PUA based hydrophobic film is proposed and analyzed. The PUA is a versatile UV-curable polymer whose structure can be readily modified and easy to make various micro patterns by using mold. The PDMS mold employed as a reusable mold for the mass production of PUA film through homemade Roll to Roll technique. The fabricated PUA based hydrophobic film showed high optical transparency and self-cleaning effect. The fabricated PUA hydrophobic film with microstructure showed high durability and permeability compared to PDMS hydrophobic film. The fabricated PUA based hydrophobic film can be used as a productive layer on the outer wall of the glass windows and the solar panel.

2. FABRICATION AND EVALUATION

The fabrication process of PUA based hydrophobic film is represented in Fig. 1. First, positive SU-8 with desired patterns were created in silicon wafer by using the conventional micro-electro-mechanical systems (MEMS) process. The inner spacing between the micro pattern is ~70 μm and height is ~20 μm. The fabricated SU-8 pattern can be used several times as a patterned template for PDMS casting. A replicating PDMS negative mold was fabricated by using the prepared positive SU-8 substrate. Subsequently, ~1ml of PUA solution was dropped into the mold surface to transfer the pattern of the PDMS using PET film as substrate The coated sample was exposed to 1620 mJ UV light at ambient temperature to cure the liquid PUA. The produced PUA film has a temporary hydrophobic effect, it has a water repellent effect. Unfortunately, dried PUA film is generally became hydrophilic because of the presence of ionic groups, which limits the application of PUA as a hydrophobic material. In order to overcome this drawback and to maintain the water repellent behavior of PUA, herein the strong hydrophobic component (nanosilica) was incorporated into the PUA film by spray coating.

The prepared PUA hydrophobic film showed high water repellent angle of ~140 degrees and also possess high optical transparency. Efficiency of the fabricated PUA film was measured under various scratch test. The change of water repellency of the PUA film was analyzed after 3, 6, and 10 times taping on the film surface and the corresponding water contact angles of the films are shown in Fig. 4. As observed in Fig. 4a the as-prepared PUA film showed a water contact angle of ~134.93 whereas, the water contact angle of the PUA film after 10 taping is ~129.91 (Fig. 4d). This analysis indicating that the as-prepared PUA film is maintained higher water contact angle even after several taping. Finally, to demonstrate the enhanced performance of the as-fabricated PUA film, it was used as a productive layer in solar cells. Experimental results are summarized in Table 1. As observed the power generation efficiency of the PUA film coated solar cell is only reduced by about 2%, which confirms that the as-prepared PUA film has no influence on power generation efficiency.

3. CONCLUSION

In conclusion, we reported the effective fabrication method for the preparation of PUA based hydrophobic film. For mass production, we fabricated reusable PDMS mold for Roll to Roll technique. The fabricated PUA film has high optical transmittance, durability with highest water contact angle of 140 degrees. Finally, the feasibility of the fabricated PUA based hydrophobic film were demonstrated through various practical applications where the periodical cleaning is required such as outer wall of buildings and solar panel.

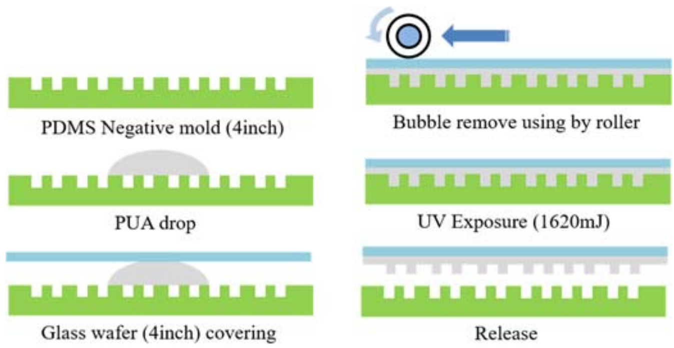


Fig. 1. Step-wise process flow for the fabrication of PUA based hydrophobic film

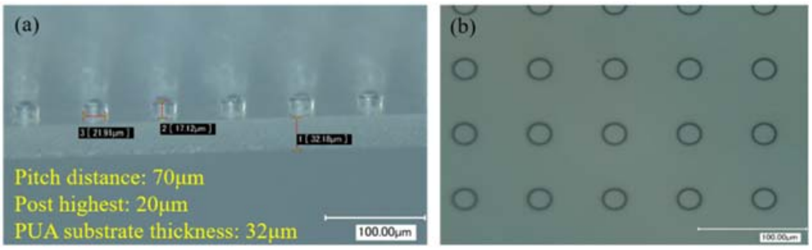


Fig. 2. Optical microscope images (a) cross sectional and (b) top view of the fabricated PUA film

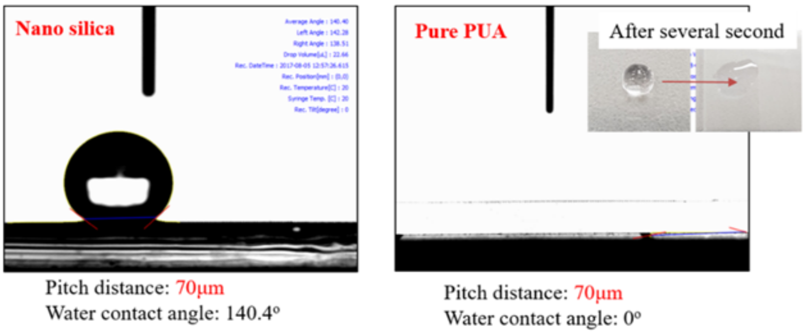


Fig 3. Comparison of water contact angle (Pitch distance 70μm PUA film) of nano-silica coted PUA film and pristine PUA film.

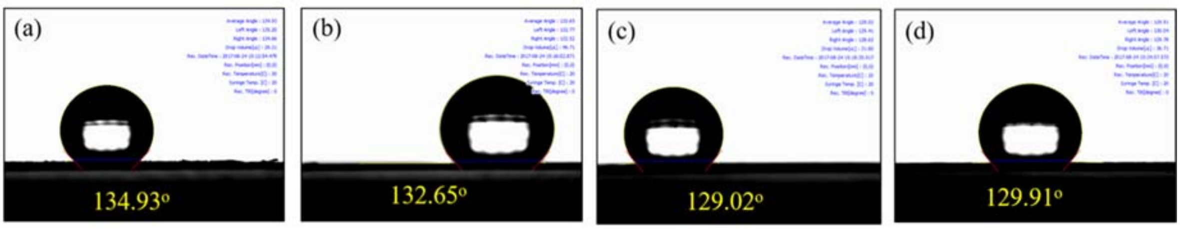
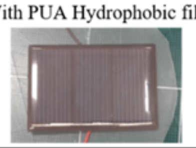
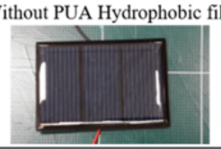


Fig 4. Durability test of the PUA based hydrophobic film. (a) as-prepared PUA phydrophobic film, (b) 3 times taping, (c) 6 time taping, and (d) 10 times taping results.

Table 1. Solar panel test results

	With PUA Hydrophobic film 	Without PUA Hydrophobic film 
Sun light	1.25V	1.27V
LED	0.74V	0.77V
Yellow lamp	0.66V	0.69V