課題番号　　:F-16-UT-0026
利用形態　　:機器利用
利用課題名(日本語)　　:
Program Title (English)　　:Study on the Cassie-to-Wenzel Transition over MEMS-Based Pillared Surface
利用者名(日本語)　　:陳昱中, 森本賢一, 鈴木雄二
Username (English)　　:Yu-Chung Chen, Kenichi Morimoto, Yuji Suzuki
所属名(日本語)　　:東京大学大学院工学系研究科機械工学専攻
Affiliation (English)　　:Department of Mechanical Engineering, The University of Tokyo

1. 概要(Summary)

The Cassie-to-Wenzel transition needs to be accurately predicted in order to have better design of droplet-based MEMS devices. In the present study, the critical voltage is predicted through 3D simulation for the liquid-air interface of the Cassie state under the electric field. The shape of liquid-air interface is calculated with the Laplace pressure from electric potential and electric field.

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置, マスク・ウエーハ自動現像装置群, 高速シリコン深掘りエッチング装置, 汎用 ICP エッチング装置

【実験方法】

The fabrication of the present super-lyophobic surface (Fig. 1) includes the equipments of EB-lithography to pattern the mask for pillared surface, CE-300I for CHF_3 plasma etching of SiO_2, and the MUC-21 for deep etching of pillar structures. The fabrication process is followed by oxidation of Si and coating of hydrophobic layer.

3. 結果と考察(Results and Discussion)

A series of experiments are also carried out with MEMS-based Si/SiO2 and CYTOP pillars, which correspond to the conductive and the dielectric pillars, respectively. The real-time motion of the liquid-air interface is monitored with a high-precision laser displacement meter. The experimental data for the critical voltage are in accordance with the simulation results, verifying the present simulation.

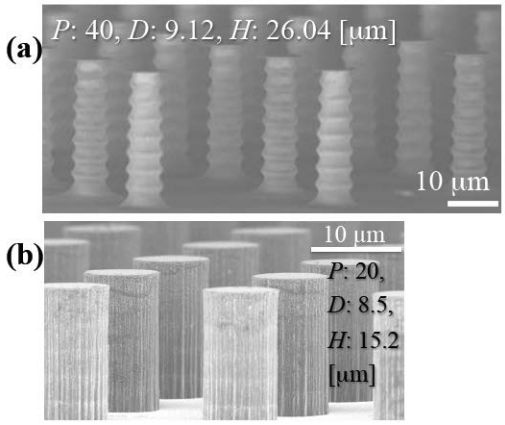

Fig. 1: SEM images: (a) Si/SiO_2 pillar, and (b) CYTOP pillar.

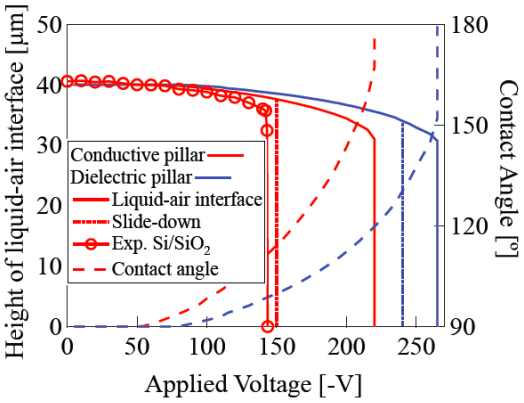

Fig. 2: The liquid-air interface and the contact angle on two types of pillar vs. applied voltage.

4. その他・特記事項(Others)

なし

5. 論文・学会発表(Publication/Presentation)

(1) Chen, Y.-C., Morimoto, K., and Suzuki, Y., Int. Symp. Micro-Nano Sci. Tech. 2016, Tokyo, SaA1-A-6 (2016).

6. 関連特許(Patent)

なし