

課題番号 : F-15-KT-0107
 利用形態 : 技術補助
 利用課題名(日本語) : 局所プラズモン共鳴によって誘起されたマランゴニ流における表面の濡れ性の影響
 Program Title(English) : Effect of Surface Wettability on Marangoni Flows Generated by Localized Plasmon Resonance
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1. 概要(Summary)

Here an investigation is conducted into the effects of surface wettability on the nature of Marangoni flows at micron scale bubbles [1]. Water vapor bubbles are generated by localized plasmon resonance in irradiated, Au nanoparticle (NP) coated surfaces. Prior to irradiation self assembled monolayers (SAMs) are used to coat NP films, changing their wettability. Film wettability, measured by water contact angle, can be adjusted by vacuum ultraviolet patterning (VUV) and significantly impacts both the shape and size of Marangoni flows over film surfaces.

2. 実験(Experimental)

【利用した主な装置】

三次元粒子トラッキングシステム

【実験方法】

Gold NP films comprised of isolated NPs roughly 450 Å thick were fabricated by dynamic oblique deposition on glass substrates. Two separate SAMs were then applied in series. The first, derived from hexadecanethiol, assembled on the gold NPs themselves and the second, derived from octadecyltrimethoxysilane, assembled on the glass substrate exposed between NPs. As fabricated both SAMs are alkyl terminated and thus hydrophobic. Samples were then subjected to VUV for varying lengths of time.

3. 結果と考察(Results and Discussion)

VUV oxidizes alkyl termination, imparting more hydrophilic character. Water contact angle, shown in Fig. 1, can thus be varied controllably. On inducement of Marangoni flow several trends emerge, including in changes in flow shape, visualized in Fig. 1 with 75 μm diameter polystyrene beads, as well as flow size and bead accumulation, as shown in Fig. 2. Work is presented in the context of designing microfluidic devices driven by Marangoni flows.

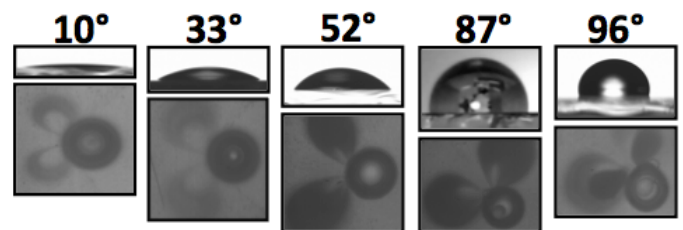


Fig. 1 Water contact angles and corresponding Marangoni flow patterns. Bubble diameters are all approximately 50 μm.

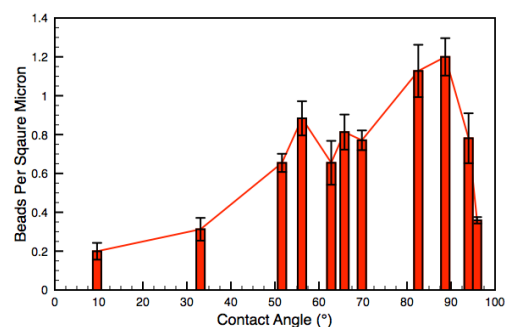


Fig. 2 Bead density in Marangoni flow areas on surfaces of differing wettability.

4. その他・特記事項 (Others)

Nothing.

5. 論文・学会発表 (Publication/Presentation)

(1) Gregory A. Pilgrim, Yudi Tu, Toru Utsunomiya, Takashi Ichii, Hiroyuki Sugimura, Kyoko Namura, Motofumi Suzuki, 第63回応用物理学会春季学術講演会.

6. 関連特許 (Patent)

Nothing.