

塗工過程における自発的な空間周期構造の発生と その制御による表面の機能化

Spontaneous Generation of Spatially Periodic Structure During Coating and its Control for Surface Functionalization

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英文要旨

When a viscous liquid is spread on a solid substrate, no flat surface but the one having spatially periodic stripe patterns is usually formed parallel to the direction of spreading. The pattern formation is due to the growth of morphological fluctuation of the interface between air and liquid, since the coating process brings the system being in far-from-equilibrium condition. When a system is open to outer environment and maintained in far-from-equilibrium conditions, various self-organized states called dissipative structures are generated by the growth of fluctuation as they are observed in living systems. The growth of morphological fluctuations of moving interfaces is called fingering and the phenomenon is extensively observed in industrial production processes that involve in surface formations. We have utilized the spontaneous pattern formation by the viscous fingering to the development of the technology for the fabrication of highly water-repellent surface. Double roughness structures composed of the mesoscopic spatially periodic stripe pattern generated by the directional viscous fingering and the microscopic dewetting pattern showed highly water-repellent properties. Not only the technology for utilizing the pattern formation in far-from-equilibrium conditions but also the one for inhibiting it was developed.

キーワード：散逸構造、非平衡系の自己組織化、ヴィスコスフィンガリング、空間パターン形成、撥水性

Keywords: Dissipative Structure, Self-organization in Far-from-equilibrium System, Viscous fingering, Spatial Pattern Formation, Water-repellent Property

1. はじめに

2枚のガラス板の間に粘性の高い液体を挟み、つづいてそのガラス板を一気に引き離すと、そ

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の高粘性液体は、中心部へ向かって円形を保ったまま収縮するのではなく、**図1**に示すように外側から指状構造を発生させながら収縮する。このように、高粘性液体の移動する界面において空間周期指状構造が自発的に発生する現象を、ヴィスコスフィンガリングと呼ぶ¹⁾。この現象は、力学的エネルギーが与えられ続け移動している界面という、平衡から遠く離れた条件下に