Micro-grid structured film with the SS processing

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Motivation

Micro/Nano structure (Bio-mimetics)
Biotic micro/nano structure can be used to address complex human problems.

Moth-eye structure
Nano-bumpy array => Anti-reflection

Lotus leaf structure
Micro-bumpy array => Water repellency

Microfabrication technology is indispensable for biomimetics.

In order to solve current problems of microfabrication, an original method utilizing the stick-slip phenomenon (SS processing) was developed and periodic micro/nano structure was formed on films.

The periodic micro/nano structure fabricated by SS processing is one-dimensional structure, however two dimensional structure is more practical.

Challenge & Purpose
Micro-grid structure is formed on a polymer film by SS processing with 2-axis. Wettability of the micro-grid structured films are investigated.

Target

Film (Surface)

Film (Cross-section)
Micro-grid structured film

Fabrication method (2-axis SS processing)

1-axis SS processed film

Processing direction

Micro-grid structured film

SPM image (surface)

SPM image (cross-section)

1st axis

2nd axis

5 µm

Processing blade

Winch

1-axis SS processed film

Stick-Slip

Weight
Summary

Fabricating micro-grid structured films with an original microfabrication method utilizing the SS phenomenon was attempted.

(1) Fabrication of micro-grid structured film

Micro-grid structured films could be fabricated by SS processing with 2-axis.

(2) Petal-like effect of the micro-grid structured film

Water contact angle of SS processed films were larger than that of the initial PET film. However, water sliding angle of SS processed films were also larger than that of the PET film. Thus, SS processed films show a petal-like effect and are not in the Cassie-Baxter state.

(3) Anisotropic wettability of the micro-grid structured film

Micro-grid structured films show anisotropy for water sliding angle because its surface structure (micro-grid structure) causes the pinning effect.