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1. 概要(Summary)

In this project, we have developed a method to produce ordered nanocellular foams. by chemical foaming. In this study, self-assembled PMMA-b-PtBA was used as a foamable matrix. The self-assembled thin films were obtained by solvent casting a PMMA-b-PtBA and PAG solution. The thin films were then foamed by UV irradiation and heating. During the foaming step, acids from the photoacid generators will act as a catalyst for the tert-butyl ester deprotection reaction, in which isobutene gas is produced. By foaming under the T_g of the matrix domain (PMMA), the gas is only produced in the PtBA domains while the PMMA domains prevented cell coalescence. As a result, ordered nanocellular foams were produced.

2. 実験(Experimental)

【利用した主な装置】

超高分解能電界放出形走査電子顕微鏡 (C1), 走査型プローブ顕微鏡システム(C4), 分光エリプソメーター (C11)

【実験方法】

A chloroform solution containing PMMA-b-PtBA and BBI-109 (Midori kagaku) was bulk casted in a glass vial. The solvent was evaporated slowly to allow the self-assembled structures to form. The polymer film was then irradiated with UV (254 nm) for 1 hour. The film was then foamed by heated at 80°C for 1-10 minutes.

3. 結果と考察(Results and Discussion)

The self-assembled structure of the as-casted film was analyzed by SAXS, TEM, SEM and AFM. Hexagonally packed cylindrical domains of PtBA in PMMA was observed. The pitch was approximately 33 nm. After the foaming at 80°C for 1-10 minutes, ordered nanocellular foams were observed by SEM. The cell size and density ranged from 16-18 nm, and 7.82×10^{15} - 1.53×10^{16} cells/cm³, respectively.

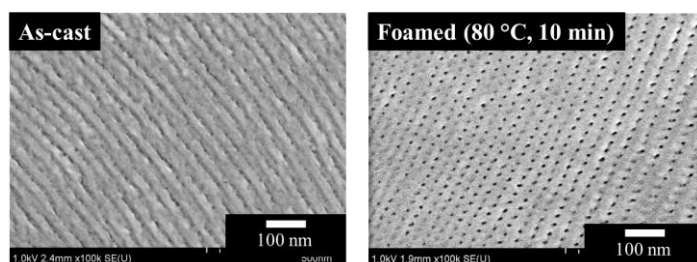


Figure 1: SEM images of PMMA-b-PtBA films before and after foaming.

4. その他・特記事項(Others)

[1] P. Rattanakawin et al., J PHOTOPOLYM SCI TEC **31(5)**, 2018, 647

5. 論文・学会発表 (Publication/Presentation)

(1) P. Rattanakawin et al., J PHOTOPOLYM SCI TEC **32(5)**, 2019, 693

(2) P. Rattanakawin et al., FOAMS 2019 (October 2-3, 2019, Valladolid, Spain)

6. 関連特許 (Patent) なし。