Dye patterning study with photochromic spiroxazine moiety

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1. Introduction

A photochromic compound is commonly characterized by its ability to undergo a reversible color change. Interest in photochromism effects with organic materials have been substantially increased due to their potential application in many new technologies such as data recording, optical switching, displays and non-linear optics[1)].

In this study, we have investigated a selective dye patterning using light stamping lithography (LSL) technique. The dye patterning was determine by optical images and the reversible properties of dye patterning were carried out with on-off switch test.

2. Experimental

2.1 Synthesis of Spiroxazine dye

Photochromic spiroxzine dye was prepared from 1,3,3-trimethyl-2-methylene-indoline and 1-nitroso-2,7-hydroxy-naphtalene according the method described in Refs[2)].

2.2 Preparation of selective photochromic dye patterning

The selective photochromic dye patterning was fabricated with light stamping lithography (LSL). LSL methods include three steps. At first, the surface of the glass slide was sequentially ultra-sonicated in acetone and ethanol, followed by sonication in distilled water, respectively. After this step, the substrate was pretreatment by piranha solution. Pretreatment of the piranha solution provides the generation of functional group (-OH) on the substrate surface. The patterned PDMS stamp was fabricated on the glass slide surface. In this process, to form chemical bonds between substrate surface and PDMS stamp, the sample was subjected to UV irradiation. Secondly, PDMS stamp is physically peeled off from the substrate. Finally, the

synthesized photochromic spiroxazine dye was deposited on the remained PDMS patterns of the substrate by hydrophobic interaction. The patterned photochromic spiroxazine dye on the substrate was washed off in ethanol to remove excess dyes and dried with nitro gas.

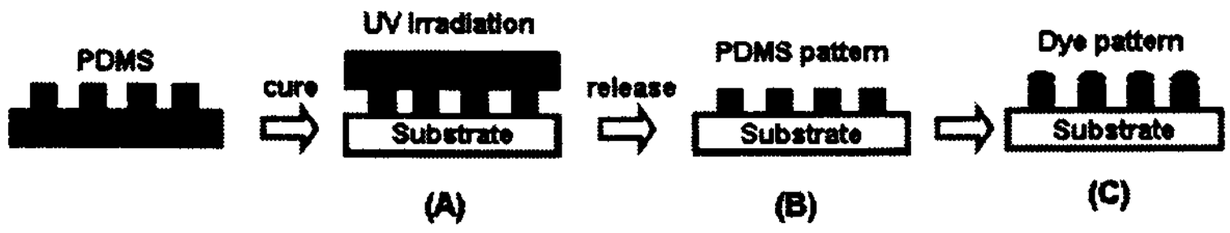

Fig. 1. Scheme of photochromic dye patterning.

3. Results and Discussion

3.1 Properties of photochromic spiroxazine

The photochromic absorption of spiroxazine was determined at 610nm. This photochromic reaction is caused by the reversible heterolytic cleavage of the C (spiro)-O bond under UV irradiation, yielding the colored form that can return to the colorless form by ring closure under visible light irradiation or in the dark.

3.2 Photochromic dye patterning

The process for the pattern of spiroxazine is shown in Fig. 1. In step A, the PDMS stamp was fabricated on the glass slide surface. The PDMS stamp is attached on glass slide surface by UV irradiation at this step. In step B, the PDMS stamp was peeled carefully from the substrate surface. In step C, the photochromic dye was deposited on the modified substrate surface by hydrophobic interaction.

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References

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