Focused surface plasmon response to gigantic birefringence of azo-polymer thin film

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Abstract

In this paper, we report the synthesis of a self-engineered homo-functionalized azo-polymer with gigantic birefringence. A reversible change in the thin film absorption is observed when illuminating it with linearly polarized monochromatic light. The tunability of the azo-polymer was further analyzed with focused surface plasmon.

Introduction

Anisotropic thin film probed by focused surface plasmon (FSP) (probe size: 180nm) revealed elliptical absorption pattern at the exit pupil plane of the focusing lens as shown in Fig. 1 [1, 2]. In the present case, thin film samples were prepared from a synthesized azo-polymer exhibiting gigantic birefringence. The FSP response was studied from the exit pupil plane of the microscope objective.

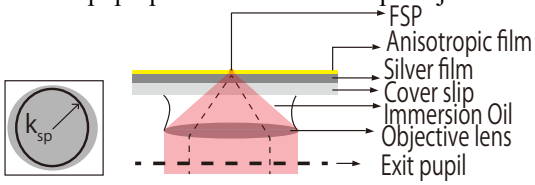

Fig. 1. Kretschmann configuration with anisotropic thin film

Preparation of gigantic birefringent azo-polymer thin film

The synthesis of the functionalized azo-polymer was performed as shown below in Fig. 2.

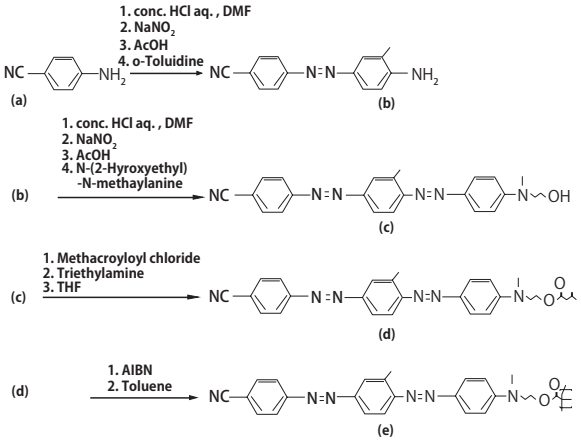

Fig. 2. Synthesis mechanism of gigantic birefringence azo-polymer

The azo-polymer (e) was synthesized from the azo-monomer (d) after free radical polymerization with 10% toluene solution. The co-polymerization ratio in the corresponding polymer was calculated from integrated peak areas of 1H NMR spectra in DMSO-d6. The synthesized azo-polymer (e) was dissolved in THF with conc of 25mg/ml and thin films were prepared by spin coating at 2500 rpm for 30 secs with thickness of 138 nm on a cover slip fabricated as Kretschmann configuration.

FSP response to azo-polymer thin film

Azo-polymers possess the capacity to orient themselves perpendicularly to the electric field upon irradiation with linearly polarized light of certain wavelengths as 473 nm which gives rise to photo-induced birefringence. The change in the eccentricity of the absorption pattern at the exit pupil of the high numerical aperture (N.A: 1.78) oil objective lens with FSP is a direct indicator of the reversible photo-induced birefringence of the synthesized polymer as shown in Fig. 3. The maximum photo-induced birefringence (Δn) was obtained as 0.3.

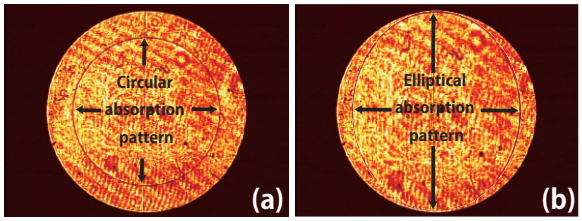

Fig. 3. Exit pupil (a) without and (b) with photo-induced birefringence with pump laser (473 nm).

Acknowledgement

The first author would like to acknowledge MEXT, Japan for the scholarship.

References

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