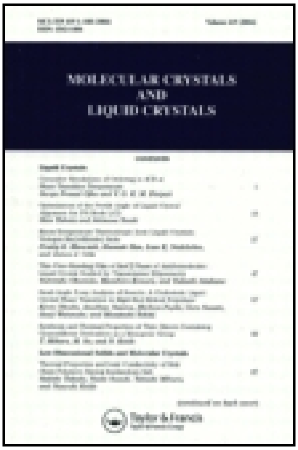

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Highly Efficient Photorefractive System Based on Carbazole-Substituted Poly(Siloxane)

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Highly Efficient Photorefractive System Based on Carbazole-Substituted Poly(Siloxane)

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Photorefractive polymer composite was prepared with carbazole-substituted poly(siloxane) as a host polymer, NLO chromophore and 2,4,7-trinitro-9-fluorenone as a sensitizer. This composite exhibited excellent photorefractive property. The gain coefficient determined by 2-beam coupling measurement was 250 cm^{-1} at 80 $V/\mu m$. And the composite was very stable toward phase separation.

Keywords: photorefractive; poly(siloxane); electro-optic; chromophore

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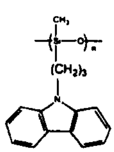
INTRODUCTION

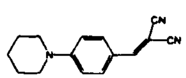
The photorefractive materials have been studied intensively due to potential applications such as high-density optical data storage and optical processing. During last decade, the performance of polymeric photorefractive system has been improved significantly. For example, the composite based on poly-*N*-vinylcarbazole (PVK) showed the high gain coefficient of > 200 cm^{-1} [1] However, PVK which is used commonly as a photoconducting host, is prone to crystallize. Furthermore composite based on PVK requires a plasticizer to lower the glass transition temperature. In many cases, the addition of plasticizer deteriorates the long-term stability of composite.

In this study, photorefractive (PR) composite was prepared with poly(siloxane) with pendant carbazole group. And the photorefractive property of composite was discussed.

EXPERIMENTAL

Carbazole-substituted polysiloxane (PSX) and 4-piperidino-benzylidene-malononitrile (PDCST) were synthesized and the chemical structures are given in Figure 1. 2,4,7-Trinitro-9-fluorenone (TNF) from Kanto





PSX PDCST

FIGURE 1 Chemical structure of molecules

Chemical Co. was used without purification. Photorefractive composite consisted of PSX (79 or 69 *wt* %), PDCST (20 or 30 *wt* %), and TNF (1 *wt* %). For measurement, the film with thickness of 100 *um* was prepared. Photorefractive properties was characterized at 632.8 *nm* by two beam coupling (2*BC*) experiment.

RESULTS AND DISCUSSION

In addition to the excellent optical properties such as clarity and low optical scattering characteristics, carbazole-substituted polysiloxane (PSX) show the high stability toward phase separation. Due to the low glass transition temperature of poly(siloxane), the composite does not require plasticizer to facilitate the orientation mobility of the electro-optic chromophore. The composites stored at room temperature retains their performance over a year. And the composites were observed to exhibit the better phase stability than the corresponding plasticized PVK system.

Photorefractive property of material is determined by 2*BC* measurement. The variation of gain coefficient for composites is given

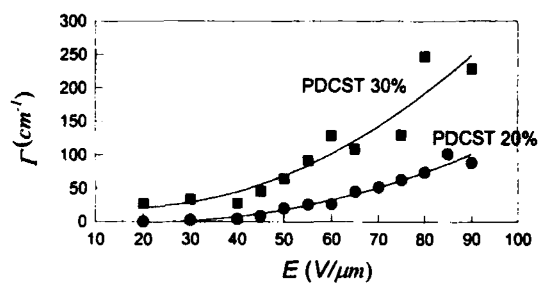


FIGURE 2 Gain coefficient (Γ) as a function of electric field

as a function of electric field, as shown in Figure 2. The result shows that the composites show excellent PR properties. The gain coefficient of composite containing 30 *wt %* of PDCST is *ca*. 250 cm^{-1} at 80 $V/\mu m$. This value is the one of the largest gain coefficient so far reported. Being compared with the corresponding PR composite based on PVK, it seems that PSX-based composite shows the better property. Recall that gain coefficient of [PVK(49.5%) /PDCST(35%) /BBP(15%) / C_{60}(0.5%)] composite was about 200 cm^{-1} at 120 $V/\mu m$[4].

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