

## Synthesis of Multifunctional Polysiloxanes for Photorefractive Effect

Jun LI, Peng REN, Cai Mao ZHAN, Jin Gui QIN \*

Department of Chemistry, Wuhan University, Wuhan 430072

**Abstract:** A novel kind of multifunctional polysiloxane containing charge-transporting agent and as electro-optical chromophore has been prepared for photorefractive application. The structural characterization of this kind of polymer is presented by IR spectra and elemental analysis.

**Keywords:** Photorefractive, polysiloxane, multifunctional polymer, synthesis, structure.

The photorefractive polymers have attracted considerable interest in 1990s due to their potential applications in coherent optical systems and several advantages over the inorganic crystals<sup>1,2</sup>. To generate photorefractive effects, the polymer must possess a photo-charge generator, a charge transporter, a charge trapping center and an electro-optical chromophore. It would be easier to dope different species into a polymer to form guest-host polymeric systems. However, there are inherent problems of phase separation and sublimation in these composite systems which adversely limit the guest-doped concentration. Multifunctional polymers where both charge-transporting agent and electro-optical chromophore are covalently linked to the polymer backbone perhaps can effectively minimize these problems. Such polymers are more stable against phase separation and sublimation during sample preparation.

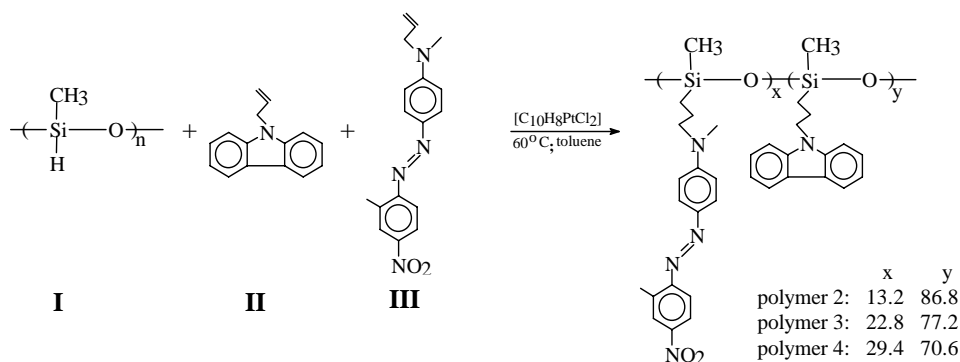
Recently we have synthesized a novel kind of multifunctional polymer possessing a potential photorefractive effect. We linked N-allylcarbazole (ACZ) and N-allyl-N-methyl-4-(2-methyl-4-nitrophenylazo) aniline (AMMNPA) to poly (methylhydrosiloxane) by hydrosilylation reaction. Carbazolyl groups offer charge-transporting agent and azo dye groups act as electro-optical chromophore. The polysiloxanes with different compositions have been obtained by controlling reagent ratio. In this paper, we report the synthesis and structural characterization of this kind of polymer presented by IR spectra and elemental analysis.

### Results and Discussion

The polysiloxanes **1-4** were prepared by a hydrosilylation reaction of poly (hydrogenmethylsiloxane) **I** with the terminal double bonds of the allyl side chains of ACZ **II** and AMMNPA **III**. We chose dichlorodicyclopentadiene platinum instead of H<sub>2</sub>PtCl<sub>2</sub> as the catalyst since it is soluble in toluene and it keeps high catalytic activity

during the period of the reaction<sup>3</sup>. In these hydrosilylation reaction, in order to make the reaction between chromophore and SiH as complete as possible, AMMNPAAs **III** were first linked to poly (hydrogenmethylsiloxane) **I** and then excessive carbazole **II** was added except for preparation of the polymer **1**, which does not contain any chromophore at all. The degree of substitution in the polymers **2-4** can be determined by elemental analysis (**Scheme 1**) which agrees with the reagent ratio.

Scheme 1



The IR spectra shows two additional absorption peaks due to the nitro group of the polymers **2-4** compared to that of the polymer **1**. The appearance of the carbazole infrared absorption at 1600, 1458, 748, 721  $\text{cm}^{-1}$  and the nitro group absorption at 1516, 1338  $\text{cm}^{-1}$  of the polymers **2-4** indicates that the functional groups **II** and **III** have been successfully introduced into the polymer backbone. In addition, it is clearly shown that the relative intensity of nitro group absorption peaks increases with increment of the chromophore in the polymers **2-4**. There is no absorption at 2155  $\text{cm}^{-1}$  in the polymers **1-4** indicating the SiH has been completely replaced. The glass transition temperatures ( $T_g$ ) of the polymers **2-4** are around 90°C (heating rate 10°C/min) and they are thermally stable up to around 280°C.

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