PHOTO-THERMAL DUAL CURED BLENDS OF TiO_2/DIARYLFLUORENE FILMS WITH HIGH REFRACTIVE INDICES

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Organic-inorganic hybrid nanocomposite materials have attracted much attention to improve physical and chemical properties of organic materials[1]. In this point of view, Matsukawa et al. reported the preparation of organic-inorganic hybrid films having high refractive indices[2-4]. They used TiO_2 and ZnO_2 as inorganic compounds, which gave high refractive indices. We also reported the fabrication of photocured films of diphenyl- or dinaphthylfluorene having acryl, epoxy, and oxetane moieties and polysilanes blends[5-8]. We have successfully fabricated the films with high refractive indices (n_D: 1.62) and the decrease of about a 0.03 refractive index was observed after the photodecomposition at 254 nm with a dose of 18000 mJ/cm^2 [7]. The prepared films have a high thermal stability (temperature for 5% weight loss, T_{d5}: 300 °C) [7].

In this study, we employed TiO_2 nanoparticle as an inorganic compound. We developed the photocured films of a blend of TiO_2 nanoparticles and dinaphthylfluorene derivatives having acryl and thiol groups and a photoinitiator by photo-thermal dual curing technique. The optical and thermal properties of the photocured films were investigated. The photocuring mechanism was also discussed. The curing properties of the blends were strongly affected by the photo-thermal dual curing conditions. We successfully fabricated films with high refractive indices (1.693 at 589 nm) and high thermal stability (5% weight loss temperature: 266 °C).

References

1. B. M. Novac, Adv. Mater., 5, 422-433, 1993.
2. K. Matsukawa, Y. Matsuura, A. Nakamura, N. Nishioka, T. Motokawa, H. Murase, J. Photopolym. Sci. Technol., 19, 89-92, 2006.
3. K. Matsukawa, Y. Matsuura, A. Nakamura, N. Nishioka, H. Murase, S. Kawasaki, J. Photopolym. Sci. Technol., 20, 307-308, 2007.
4. Y. Minami, K. Murata, S. Watase, A. Matsumoto, K. Matsukawa, J. Photopolym. Sci. Technol., 26, 491-494, 2013.
5. H. Okamura, K. Funamoto, M. Matsumoto, K. Minokami, S. Miyauchi, J. Photopolym. Sci. Technol., 27, 525-528, 2014.
6. H. Okamura, M. Iseki, K. Degawa, A. Matsumoto, K. Minokami, S. Miyauchi, J. Photopolym. Sci. Technol., 30, 683-688, 2017.
7. H. Okamura, A. Matsumoto, K. Minokami, S. Miyauchi, J. Photopolym. Sci. Technol., 31, 503-510, 2018.
8. H. Okamura, K. Minokami, S. Miyauchi, J. Photopolym. Sci. Technol., 33, 279-284, 2020.