

Highly Transparent Polyimide Copolymer with Large Stokes Shifted Fluorescence based on Excited State Intramolecular Proton Transfer

Naiqiang Liang, Mayuko Nara, Eisuke Fujiwara, Ryohei Ishige and Shinji Ando*

Department of Chemical Science and Engineering, Tokyo Institute of Technology, Tokyo, Japan
nliang@polymer.titech.ac.jp

ABSTRACT

Polyimide (PI) is a kind of polymer with excellent comprehensive properties. In particular, a group of semi-aromatic PIs can exhibit strong fluorescence due to the suppression of charge transfer.[1, 2] For example, our group has reported PI film using 1-hydroxy pyromellitic dianhydride (PHDA). This polymer shows a very large Stokes shifted photoluminescence based on excited-state intramolecular proton transfer (ESIPT) in the PHDA unit. The PHDA-based PI is one of the promising materials for solar spectral converters used in an extreme environment.[3] However, due to the charge-transfer (CT) absorption induced by the strong aggregation of the PHDA unit, this PI film shows yellowish color, as well as low fluorescent efficiency, which may become an obstacle to practical applications. To solve this problem, we have synthesized a series of PI copolymers based on PHDA and 4,4'-oxydiphthalic anhydride (ODPA), and investigated the photophysical behavior of these copolymer films. All copolymer films exhibit colorlessness and high transparency, which clearly indicates the molecular aggregation is suppressed. Although the molar ratio of PHDA unit in these copolymer films is only several mol%, all copolymer films still retain reddish fluorescence with large Stokes shifts, which proves that efficient energy transfer occurred from the large excess of ODPA unit to the small amount of PHDA unit. These highly transparent and large Stokes shifted photoluminescent films have great potential for solar spectral conversion.

References

- [1] J. Wakita, H. Sekino, K. Sakai, Y. Urano, S. Ando, *J. Phys. Chem. B*, **46**, 113, 2009.
- [2] J. Wakita, S. Inoue, N. Kawanishi, S. Ando, *Macromolecules*, **8**, 43, 2010.
- [3] K. Kanosue, R. Augulis, D. Peckus, R. Karpicz, T. Tamulevicius, S. Tamulevicius, V. Gulbinas, S. Ando, *Macromolecules*, **5**, 49, 2016.

Short BIOGRAPHY



Education:

Apr. 2018 – Now Tokyo Institute of Technology, Ph.D Candidate

Professional Career:

2016.03-2016.07 TA for Organic Chemistry Experiment

2016.03-2017.03 TA for Bachelor Student Graduation

2018.06-2018.07 TA for Elements of Polymer Science 1

Research Interests:

Aromatic Polymers, Polyimide, Photoluminescence,

Professional Activities:

Magic, Basket Ball,