

Photochromism of the Bridged Imidazole Dimers with Flexible Moieties

Katsuya Mutoh, Yoichi Kobayashi, Jiro Abe

Department of Chemistry, School of Science and Engineering, Aoyama Gakuin University,
5-10-1 Fuchinobe, Chuo-ku, Sagami-hara, Kanagawa 252-5258, Japan

E-mail: jiro_abe@chem.aoyama.ac.jp

The photochromic compounds show reversible color changes upon irradiation with light. The T-type photochromic compounds, which generate the thermally unstable transient colored species, have a potential to be applied to the ophthalmic lenses. Recently, we developed the fast-switchable photochromic compounds, bridged imidazole dimers, which generate the transient colored biradical species.^[1,2] Because the two radicals are closely coupled with the bridging moiety, the thermal recombination reaction between the radicals is accelerated. Pentaarylbiimidazole (PABI) is the simplest imidazole dimer by using a phenylene group as the bridging moiety.^[3] This simple architecture is very easy to synthesize, and enables us to develop several types of derivatives. In addition, one of the imidazolyl radicals can be replaced by the phenoxy radical, phenoxy-imidazolyl radical complex (PIC), which is the first photochromic compound which generates a hetero-radical pair.^[4] These fast-switchable photochromic compounds are useful not only for the ophthalmic lenses but also for the holographic materials, fluorescence switch, and light-driven molecular machines.

Here, we developed a novel-type of the bridged imidazole dimer **1**. The transient absorption spectrum of **1** is shown in Fig. 1. The broad absorption bands from 400 nm to 900 nm were observed upon 355-nm laser irradiation (5 ns) in benzene. The transient absorption spectral shape was not changed during the thermal back reaction. However, the decay profile of the transient absorbance at 540 nm and 775 nm do not follow the first-order reaction kinetics. These results suggest that the transient colored isomer has at least two conformations which go back to the initial isomer with different recombination pathways due to the flexibility of the bridging moiety.

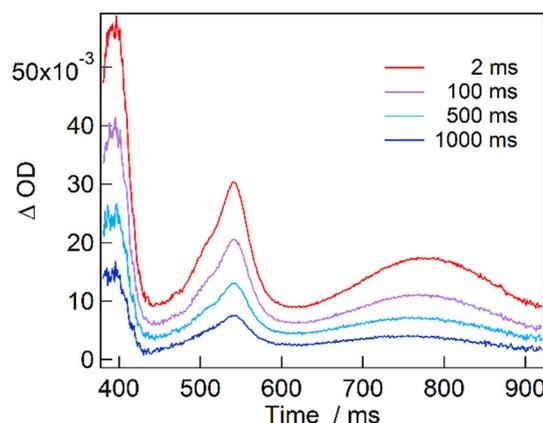


Figure 1. Transient absorption spectra of **1** in benzene at room temperature ($\lambda_{\text{ex.}} = 355$ nm, 5 ns, 5 mJ).

References:

- [1] Y. Kishimoto, J. Abe, *J. Am. Chem. Soc.*, **2009**, 131, 4227
- [2] T. Iwasaki, T. Kato, Y. Kobayashi, J. Abe, *Chem. Commun.*, **2014**, 50, 7481
- [3] H. Yamashita, J. Abe, *Chem. Commun.*, **2014**, 50, 8468
- [4] H. Yamashita, T. Ikezawa, Y. Kobayashi, J. Abe, *J. Am. Chem. Soc.*, **2015**, 137, 4952