

## Novel photochromic chiral dopant having bisanthracene units

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Binaphthyl derivatives are powerful inducers of helicity in achiral nematic liquid crystals. A dihedral angle between two naphthalene moieties in the binaphthyl derivative plays a key role in determining its cholesteric induction ability and helical twisting power.<sup>[1]</sup> They can be tuned by light when the photochromic unit is incorporated into the binaphthyl derivative.<sup>[2,3]</sup> In general photochromic systems, the stable colorless isomer photoisomerizes into the less stable colored isomer upon UV light irradiation. In contrast, a pair of anthracenes dimerizes in a [4+4] cycloaddition upon irradiation with UV light, and the dimer reverts back to the original state on photolysis with deep UV light or on thermolysis<sup>[3]</sup> (Fig. 1a). It will be a good candidate for application of photochromic chiral dopant, because it exhibits stealth photochromism. In this research, we synthesize a binaphthyl derivative that bears two anthracene moieties, and investigate its photochromic properties and ability as a chiral dopant.

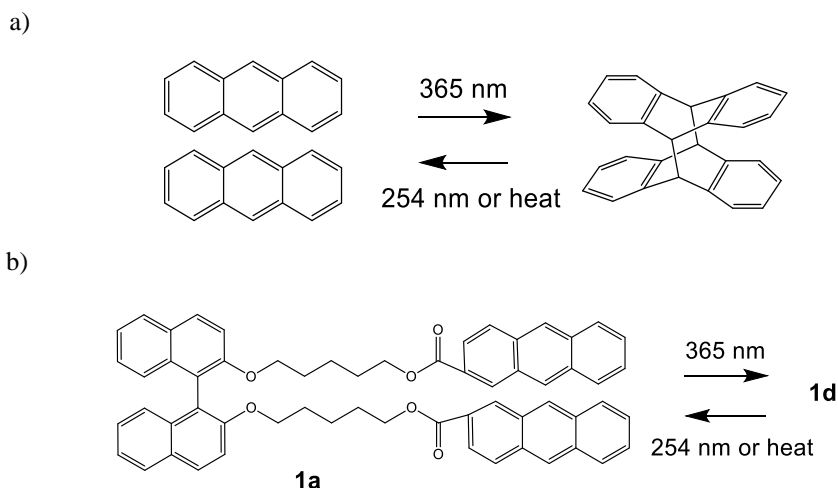


Figure 1 a) Photoreaction of a pair of anthracenes.

b) Molecular structure of **1a** and its photoisomerization.

The new compound **1a** was prepared by synthesis starting from 2-anthracenecarboxylic acid (Fig. 1b). As expected, **1a** exhibited stealth photochromic behavior in solution, as was confirmed by UV absorption spectra (Fig. 2). Upon UV (365 nm) light irradiation, **1a** transformed into intramolecular dimer **1d**. Absorption spectra studies revealed that the photochemical conversion proceeded perfectly (Fig. 2a). **1d** was thermally stable as no spectral change was observed in the heating at 60°C at least

for 20 h. 25% of **1d** could be switched back to **1a** by irradiation with 254-nm light as shown in Fig. 2b.

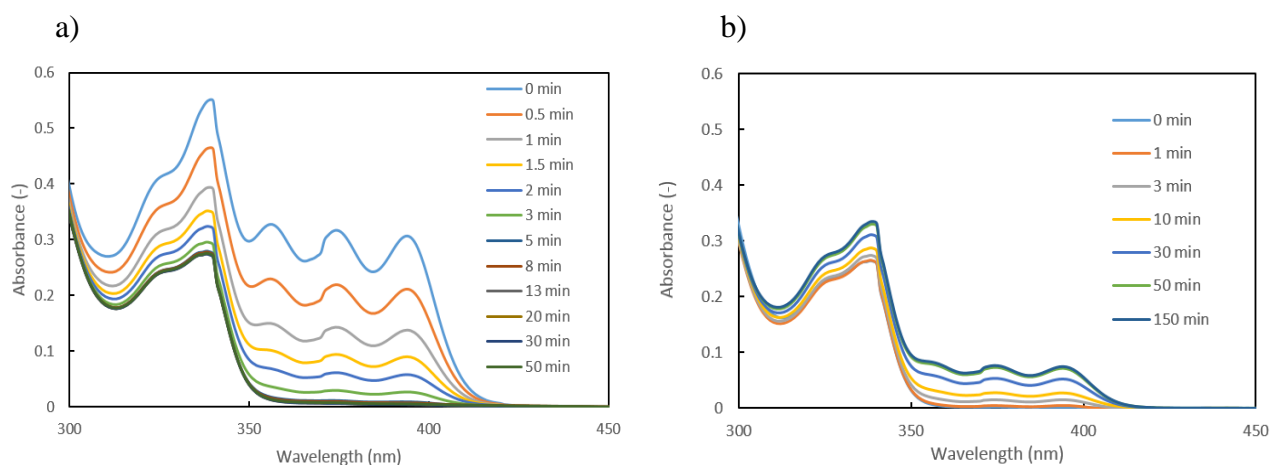


Figure 2 UV/Vis absorption spectral changes of **1** by irradiation with UV light: a) 365 nm b) subsequent 254 nm

After investigating the photoisomerization process in solution, we examined the performance of the **1** as chiral dopant in nematic liquid crystal of 5CB. With a polarized microscope, a cholesteric phase was observed. The helical twisting power were determined by the method of Cano and contact test with right-handed cholesteric liquid crystals. The helical twisting powers of **1a** and **1d** in 5CB were calculated to be  $+58 \mu\text{m}^{-1}$  and  $-50 \mu\text{m}^{-1}$ . The power of inducer of helicity changed dramatically. More interestingly, it resulted in handedness inversion of the induced cholesteric liquid crystals with moderate to high helical twisting power in both states.

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