

All-Organic Photochemical Spin-State Switching

Oliver Dumele¹

¹ Humboldt-Universität zu Berlin, Department of Chemistry, Brook-Taylor-Strasse 2 12489, Berlin, Germany
oliver.dumele@hu-berlin.de

Digital data storage relies on the change of a material's electrical, magnetic, or optical properties between two states, indicating 1 and 0. Smaller units of information storage are an interesting research target, because they could lead to higher-density storage. Molecular organic switches are interesting in this context.^[1] However, the switching of spin states in all-organic molecules is challenging.

This contribution gives an overview of several past attempts of organic spin-switching by light and it will focus on the recently developed helical photochemical switch systems.^[2] Configurationally stable dimethyl[5]helicenes were used in the design of a photochemical magnetic switch with bistable spin states (Figure 1).^[2] When introducing quinoidal 4,11-substituents, such as oxo or dicyanomethylidene, the helicene undergoes rapid electrocyclicization which can be reversed using light as stimulus (77 K). Upon photochemical ring opening at cryogenic temperatures, the helicene favours a diradical configuration with a triplet ground state and a stable EPR signal. The process is fully reversible under thermal conditions and heating (to 93 K for R = C(CN)₂ or 127 K for R = O) recovers the diamagnetic closed-shell form via electrocylization. The system can be cycled without any significant degradation and represents a bistable photomagnetic switch that operates under chemical reactivity. Concepts and strategies to expand this operation mode to ambient conditions (room temperature) will be discussed.

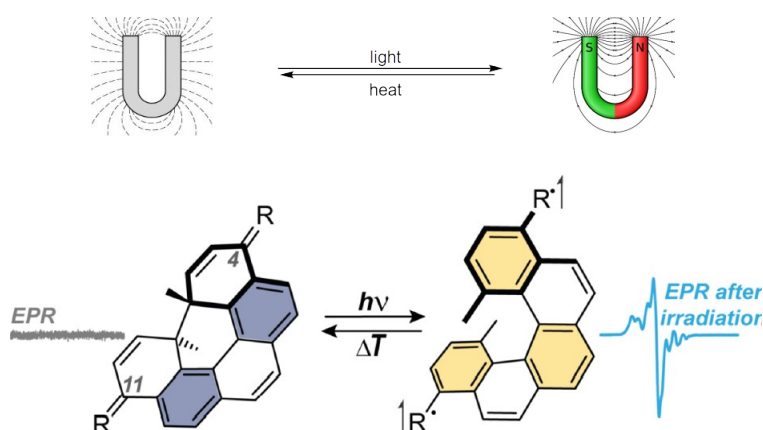


Fig. 1. 4,11-Substituted dimethyl[5]helicene for photochemical magnetic switching.

Reference.

[1] For a full journal issue on molecular spintronics and quantum computing, see E. Coronado, A. J. Epstein, *J. Mater. Chem.* **2009**, *19*, 1670–1671.

[2] K. Günther, N. Grabicki, B. Battistella, L. Grubert, O. Dumele, *J. Am. Chem. Soc.* **2022**, *144*, 8707–8716.