Combination of two amplification phenomena for high-sensitivity detection

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Terarylenes are a specific family of photochromic diarylethenes where certain derivatives can undergo the cascading effect (CE): a single oxidation input may cause the spontaneous ring opening of up to 1000 terarylene units.[1] On the other hand, amplified fluorescence photo-switching (AFPS) has been observed in nano-size materials, where switching a single photochromic unit can cause large scale energy transfer (here namely FRET - Förster Resonance Energy Transfer) and therefore fluorescence quenching of up to 400 fluorophores.[2] Combining these two phenomena can lead to highly sensitive detectors, where an external trigger can cause a change in the absorption properties of the terarylene which in turn is detected via fluorescence quenching.

As the first steps for this purpose, BODIPY and terarylene derivatives were synthesized. Also, as a model system for describing FRET, the BODIPY derivative was paired with a commercially-available photochromic compound in a polymer matrix. FRET efficiency, fatigue resistance, and fluorescence and absorption profiles were investigated as a function of irradiation time.

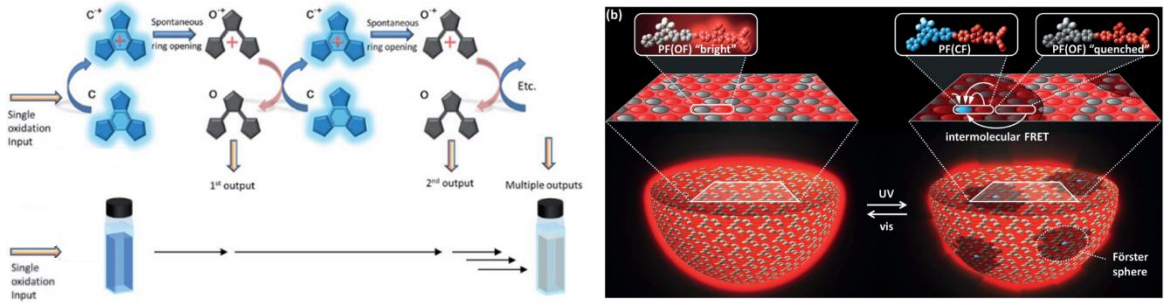

Figure 1. Illustration of the two amplification phenomena: Cascading Effect (CE, **left**) and Amplified Fluorescence Photo-Switching (AFPS, **right**).

[1] Asato, R., Martin, C. J., Calupitan, J. P., Mizutsu, R., Nakashima, T., Okada, G., Kawaguchi, N., Yanagida, T., Kawai, T., *Chem. Sci.*, 2020, 9 (11), 2504-2510.

[2] Su, J., Fukaminato, T., Placial, J.-P., Onodera, T., Suzuki, R., Oikawa, H., Brosseau, A., Brisset, F., Pansu, R., Nakatani, K., Métivier, R., *Angew. Chel. Int. Ed.*, **2016**, 55 (11), 3662-3666.