FROM NANOSCOPIC MOLECULAR PHOTODECAGING TO MICROCAPSULE EXPLOSION : UPSCALING PHOTORELEASE

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Molecular-scale photodecaging has been shown to lead to programmable rupture of cell-sized vesicles, with particular emphasis on self-assembled polymersome capsules.[1] As a result, photoliberation of molecular cargo in pseudo-physiological conditions is demonstrated. Snapshots of a real-time micrometric polymersome explosion under irradiation is shown in the Figure 1.

The mechanism involves a hypotonic osmotic imbalance created by the accumulation of photogenerated species inside the lumen, as a result of photodecaging. As this cannot be compensated owing to the low water permeability of the membrane vesicle, a rupture occurs and contents are liberated. This simple and versatile mechanism can be adapted to a wealth of hydrosoluble dye molecules, which are either able to generate reactive oxygen species or undergo photocleavage, offering high spectral and spatio-temporal control. Current works seeks to develop biocompatible systems involving different copolymers and several water-soluble dyes, affording photoactivity across the visible spectrum.

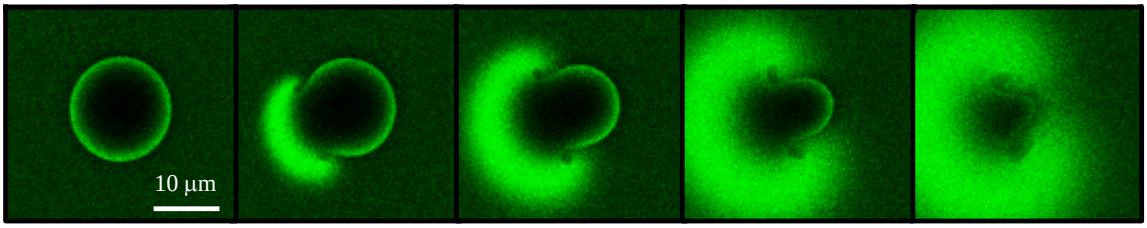

Figure 1 : Snapshots of a photodriven polymersome explosion under irradiation at 488 nm (confocal fluorescence microscope observation, each frame is separated by 70 ms).

[1] Peyret, A.; Ibarboure, E.; Tron, A.; Beauté, L.; Rust, R.; Sandre, O.; McClenaghan, N. D., Lecommandoux, S., Angew. Chem. Int. Ed. 2017, 56, 1566.
[2] M. J. Hansen, W. A. Velema, M. M. Lerch, W. Szymanski, B. L. Feringa, Chem. Soc. Rev., 2015, 44, 3358
[3] R. Weinstain, T. Slanina, D. Kand, P. Klań, Chem. Rev. 2020, 120, 13135.