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Photon-triggered polymersome rupture under temporal, spatial and spectral control

Ariane Peyret^a, Emmanuel Ibarboure^a, Arnaud Tron^b,
Louis Beauté^{a,b}, Ruben Rust^b, Olivier Sandre^a,
Nathan McClenaghan^b, Sebastien Lecommandoux^a

^aLaboratoire de Chimie des Polymères Organiques, CNRS, Université de Bordeaux INP/ENSCBP, 16 avenue Pey Berland, 33600, Pessac, France

^bInstitut des Sciences Moléculaires, CNRS/Université de Bordeaux, 351 cours de la Libération, 33405, Talence, France

E-mail addresses: ariane.peyret@enscbp.fr (A. Peyret),
nathan.mcclenaghan@u-bordeaux.fr (N. McClenaghan),
lecommandoux@enscbp.fr (S. Lecommandoux)

Polymersomes are robust self-assembled vesicular structures that are widely studied in a variety of domains from nanomedicine to artificial cell design [1]. Control over their membrane diffusion properties and structural integrity is crucial for their future development [2]. In particular, a high level of control is mandatory in drug delivery applications where species have to be released at the right place and time. Here, we present a high precision method allowing programmed vesicle rupture with full control in time, space and excitation wavelength for selective cargo-release.

We designed an easy and tunable protocol for light-driven specific polymersome rupture controlled in time and space, which combines the advantages of utilizing light as a trigger and the fast release of components from bursting vesicles. Our system is based on laser excitation of hydrophilic dyes loaded in the lumen of distinct giant poly(butadiene)-*b*-poly(ethylene oxide) polymersomes. Upon excitation,

the fast generation of reactive oxygen species leads to an increase of the internal osmotic pressure that can not be compensated fast enough, resulting in subsequent vesicle rupture (Fig. 1). This process allows for a precise and fast release of entrapped species from different compartments. Additionally, such a selective mechanism allows discrimination between two types of vesicles within a group of many and successive triggered release of their content without altering the remaining vesicles. This unique mechanism is shown to selectively rupture polymersomes with high precision, and even to deliver small polymersomes and liposomes.

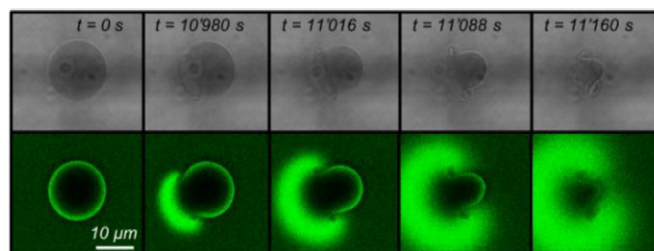


Fig. 1. Confocal microscopy images of controlled rupture of a polymersome under laser irradiation.

Keywords: triggered rupture, polymersomes, cargo-release, self-assembly, light stimulus

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