

## Deformation of magnetic polymer vesicles (polymersomes) under magnetic field and photo-crosslinking of their membrane in their deformed state

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Magnetic polymersomes containing iron oxide magnetic nanoparticles (IONPs) have been studied mainly in the magnetic hyperthermia concept, as potential anticancer treatment. On the opposite, the use of magnetic polymersomes as mechanical actuators capable of inducing cell apoptosis by strong membrane distortion from within has not been investigated.

Herein, the above hypothesis is explored by the synthesis of a new model system. In order to achieve mechanical destruction it is imperative that an anisotropic morphology is attained in order to exert a torque on the membranes when applying a rotating magnetic field (RMF). This work reports the synthesis and investigation of ellipsoid like magnetic polymersomes capable of rotating around their axis after the application of a RMF of low frequency (LF). Specifically, hydrophobically modified IONPs are embedded in the hydrophobic membrane of “block-brush” copolymers designed to self-assemble into a vesicular shape. The copolymer consists of a poly(ethylene glycol)-*block*-poly(amino trimethyl carbonate) (PEG-*b*-PATC) diblock copolymer that has been further modified via a “grafting to” process, using reductive amination to attach a carbonyl telechelic 1,4-*cis*-poly(isoprene) oligomer, resulting in the “block-brush” copolymer PEG-*b*-(PTDOC-*g*-PI). The final copolymer is modified once more by partial epoxidation of the PI block, which allows the further cross-linking step.

After the formation of the vesicles is confirmed, a static magnetic field is applied which aligns the IONPs in linear aggregates in its direction. The alignment of the IONPs prompts a morphological shift of the polymersomes, due to the fluid state of the hydrophobic membrane, resulting in an ellipsoid like morphology. The final morphology is permanently stabilized by photo-crosslinking of the hydrophobic membrane *via* a ring-opening polymerization of the epoxidized poly(isoprene) block. These ellipsoidal polymersomes were shown biocompatible up to 10 µg/mL, and they are currently tested for their capacity to exert mechanical torques on membranes after their uptake by cancer cells.

