**Abstract Template**

**Title: Responsive Hybrid Inorganic-Organic Polymer Capsules & Structural Assembly**

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**Keywords: Encapsulation, Polymer, Branched, Emulsion, Capsule, Drug Delivery**

**I. Abstract Body**

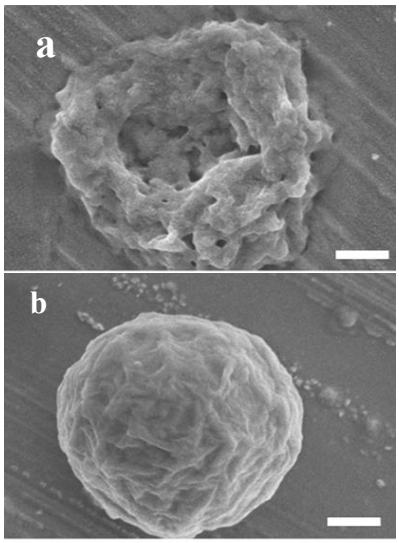
Strategies to encapsulate actives, such as drugs or catalysts, and to fabricate hollow capsules have received considerable attention in research. Furthermore, the delivery, or release, of the trapped active is a key area of our research. We have developed a new hybrid capsule production technique, where a multi-functional branched copolymer is exploited as both emulsifier and cross-linker[1,2]. The strategy has the key advantages of: (i) being single component, (ii) producing stable capsules and (iii) providing additional capsule surface chemistries by design.

The capsule formation process both exploits and relies on polymer architecture and composition. The chosen architecture provides stability and efficient surfactant properties[3]. The copolymer composition provides extra stabilization and capsule-formation function. This strategy provides a generic and translatable method for encapsulating hydrophobic materials and producing hollow capsules, which may have applications in catalysis, delivery and sensing devices. Product development has been conducted with tier 1 and 2 customers on the entrapment and release of drugs, dyes, fragrances, catalysts, and pesticides.

In principle, the diversity of compositions accessed using the polymer synthetic route provides a wealth of opportunity in terms of functionalizing the capsule surfaces. It is possible to hand-pick moieties and pre-determine the surface chemistry for tailored applications. This has been shown by tailoring the polymer to create stimuli-responsive capsules and 'burst-release' breakable capsules, respectively. We also demonstrate how control over copolymer composition can direct the assembly of capsules into shapes or permanent porous scaffolds.

Given this potential scope, we anticipate various applications of these materials in broad research areas that require encapsulation of actives for extended periods and functionalized capsule surfaces. There is massive commercial interest because of the use as a repository into which other materials can be put and protected. The applicability of design-led functional responsive polymers is key for many commercially relevant applications.

**II. Image:**




*SEM images of (a) unloaded, and (b) active-loaded capsules. Scale bar represents 500 nm.*

**III. References:**

1 Harbron, R. L., McDonald, T. O., Rannard, S. P., Findlay, P. H., Weaver, J. V. M. (2012). One-pot, single-component synthesis of functional emulsion-templated hybrid

inorganic-organic polymer capsules. *Chemical Communications.* 48. pp.1592-1594.
2 Harbron, R. L., Findlay, P. H., Pears, D. P. (2018). *Novel Process.* WO2018109469.
3 J. V. M. Weaver, D. J. Adams, *Soft Matter* 2012, *6*, 2575–2582.

**IV. Biography:**

Dr RL Harbron obtained her PhD (industry-sponsored) from Imperial College London, UK, within the departments of Bioengineering, and Materials. Rachel's interests in Biomaterials led her to a post-doctoral stay with Prof. PYW Dankers at the Eindhoven University of Technology, Netherlands. To further explore polymer technologies, she joined Revolymer Ltd., UK, a start-up company dedicated to commercially relevant applied materials science and the development of sustainable polymers. Further to this, she worked within industrial R&D at Innospec Inc. Rachel has authored peer-reviewed papers (notably Nature Chemistry, 2013) and patents. Having recently moved to the UAE, she is now focused on finding further research activities, consultancy, lecturing and mentoring.

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