

The importance of metal nanoparticle adsorption during emulsification in the formation of metallic microcapsules for the retention of low molecular weight species

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Microencapsulation of small volatile chemicals remains an unsolved challenge for both industry and academia as most capsule walls tend to be permeable to such species. This is particularly prominent for small actives such as those found in drugs, vitamins, fragrance and flavour oils. Metal coated capsules are of particular interest as they offer much reduced diffusion coefficient for this same species. A continuous metal shell can provide reduced permeability compared to a standard polymer shell and can prevent the escape of volatile encapsulated compounds. Additionally, there is potential opportunity to exploit electrical, mechanical, optical and magnetic properties of the metallic shell for further capsule functionality. Metal encapsulated compounds can have improved shelf life, potentially including those with high sensitivity to water and oxygen. They also offer the opportunity for remote triggered release by means such as ultrasound, which could be utilised for controlled drug delivery.

Metallic encapsulation of small species has successfully been demonstrated within our research group¹. The method has now been developed so that a metal shell is grown directly onto an emulsion droplet stabilised by a catalytic metal nanoparticle emulsifier. The key stage in the fabrication of the capsules is the adsorption of the nanoparticles at the oil-water interface during emulsification. An even, densely packed layer at the interface is crucial for the subsequent electroless deposition of a secondary metal which encapsulates the oil. In this presentation, we will describe the processes leading to permanent encapsulation of small, volatile oils within metal shell capsules and specifically concentrate on exploring the electrolyte concentration on the adsorption of the nanoparticles at the oil-water interface.

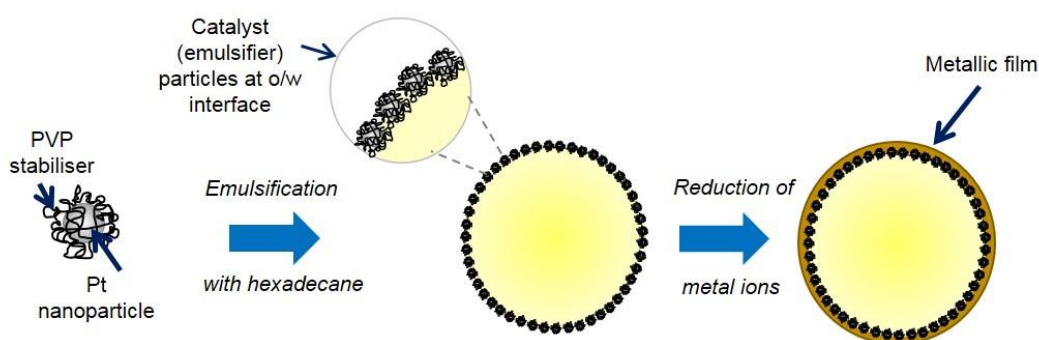


Figure 1: Schematic showing the fabrication process on metallic capsules via a polymerically stabilised nanoparticle emulsion template

- [1] J. P. Hitchcock, A. L. Tasker, E. A. Baxter, S. Biggs and O. J. Cayre, *ACS Applied Materials & Interfaces* **2015**, 7, 14808-14815.