Providing permeability to microcapsules with incorporated ion channels

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Nanobiotechnology is an interdisciplinary field of research and development that integrates engineering, physical sciences, and biology through the development of very small physical and biological devices using biomimetically inspired nano-fabrication techniques[1]. In this presentation I will describe a nanobiotechnology approach for the fabrication of ion-transporting microcapsules. These microcapsules have developed from my studies of liposomes[2] and ion-channel electrophysiology[3,4] and are a step towards constructing an artificial cell which has several biomedical applications[5]. The microcapsules are based on hollow poly(sodium styrenesulfonate) (PSS)/poly(allylamine hydrochloride) (PAH) microspheres that support a lipid bilayer membrane. Engineered ion channels are incorporated into the lipid membrane coating to provide a functional capability to control transport across the microcapsule wall. This controlled transport can be tuned for selective release biomimetically by controlling the gating of the incorporated ion channels. This system provides a platform for the creation of ''smart'' biomimetic delivery vessels for the effective and selective therapeutic delivery and targeting of drugs. We have also considered ways to use this system as a biosensor that is based on the change in gating of the incorporated ion channels[6].

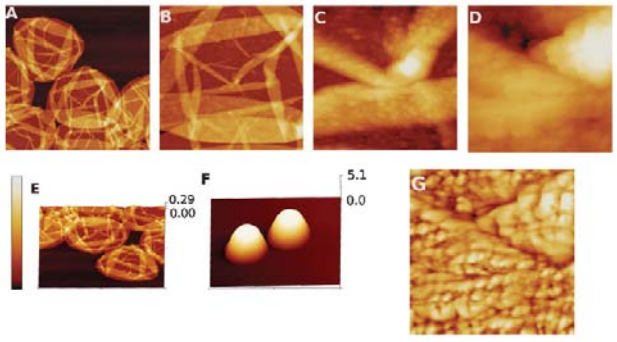
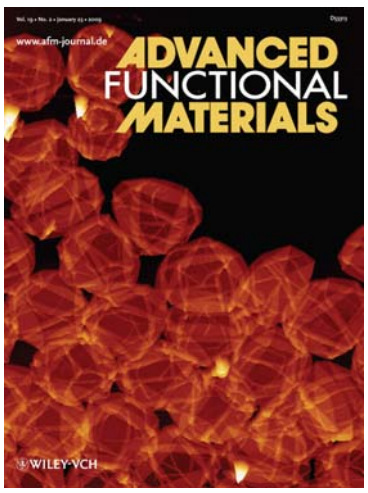


Figure 1. AFM images of eight layer PAH/PSS polyelectrolyte capsules recorded in an aqueous environment. A–D) Uncoated capsules collapse on the surface (frame size: 16, 5, 1, and 0.5 μm, respectively; height as of color scale on the left: 290, 286, 150, and 129 nm, respectively); E) 3D rendered version of (A), showing a folded, layered structure; F) lipid-coated spheres do not collapse; G) fine structure of the layer [local contrast enhanced (D)], showing the intermingling polyelectrolytes.



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