Ultrathin Polydopamine Films with Phospholipid Nanodiscs Containing a Glycophorin A Domain

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Inspired by a mussel adhesive, polydopamine (PDA) has earned great acclaim as a multifunctional coating. Its easy synthesis, the ability to adhere to virtually any surface and its biocompatibility makes polydopamine an interesting material for preparing films used in various fields of research ranging from energy to environmental to biomedical. Here, we use electropolymerization to provide highly controlled deposition of polydopamine and other catecholamines on conductive surfaces. Motivated by the precise control achievable by electropolymerization, polydopamine films can be fabricated on conductive substrates with nanometre thickness and outstanding elastic moduli. Since electropolymerization only occurs at the conductive surface, it is possible to embed non-conductive materials within the PDA matrix. We were able to directly incorporate phoshoplipid nanodiscs with glycophorin A domain into the polycatecholamines to provide functional films and membranes. AFM-IR-measurements revealed that the nanodiscs were retained in the film, emphasizing that electropolymerization is a mild process. Moreover electrochemical tests further proved the availability of the lipids after embedding (figure 1) indicating that the nanodiscs were not completely overgrown by PDA. This approach opens many new avenues for creating hybrid films with novel properties and increased stability. Polydopamine provides a versatile foundation for the design of hybrid membranes paving the way for new biomimetic materials leading to the development of cell mimicking nanocomposites. The formation of complex biosensing platforms by, for instance, developing microfulidic devices with incorporated transmembrane receptors would be possible.

REFERENCES

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FIGURES

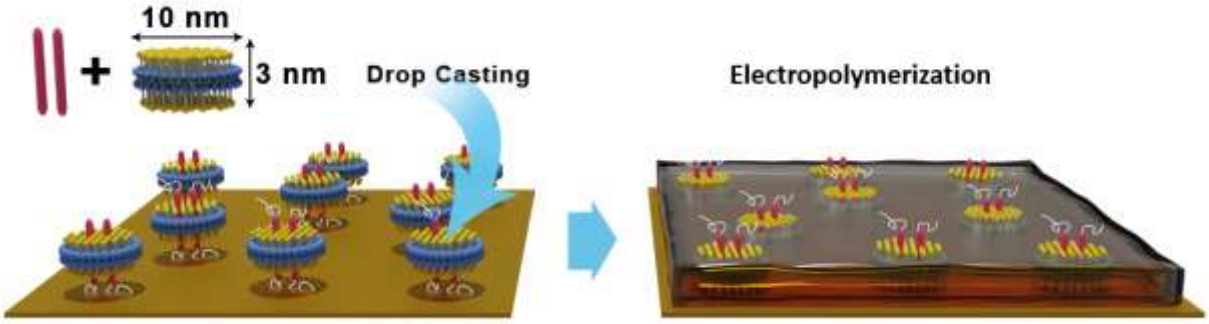

Figure 1: Schematic representation of the process to embed Phospholipid nanodiscs into polydopamine matrix on gold substrate.