Biomimetic Catechol Bearing Polymers for Functional Coatings

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As a key structure of the adhesive proteins of mussel, catechol chemistry has drawn worldwide research interest in the past decade. In this work, the application of catechol bearing polymers as substrate independent adhesive coatings for the fabrication of functional surfaces were studied. Several copolymers with catechol units were designed and synthesized and further used for surface functionalization. It was found that catechol bearing copolymers can be applied as a substrate-independent adhesive platform for layer-by-layer (LBL) assembly, [1] for the generation of thermally stable liquid-repellent thin film, as a novel material for the creation of superamphiphobic coating, [2] and for photo-induced polymer grafting on solids.

Fig. 1 shows the microstructure of two films observed by AFM. These films were fabricated by LBL assembly of poly(ethyleneimine) (PEI) and poly(acrylic acid) (PAA) on a catechol bearing polymer coating. Through controlling the surfaces roughness of the LBL films by using spin-assisted and dip-assisted LBL processes, sticky and non-sticky underwater superoleophobic surfaces were obtained, respectively. Fig. 2 shows a superamphiphobic coating based on a copolymer of 2-(perfluorooctyl)ethylacrylate and dopamine acrylate (P(FAC_8-*co*-DA)) and halloysite nanotube (HNT). Due to the presence of catechol groups, P(FAC_8-*co*-DA) can adhere HNT to form a stable coating, meanwhile lowers the surface free energy. As a result, the hybrid coating showed an excellent superamphiphobicity with good mechanical durability.

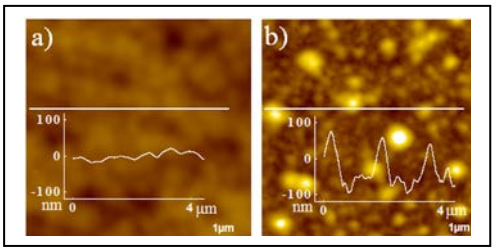

Fig. 1. Tapping mode AFM images of spin-assisted (a) and dip-assisted (b) $(PEI/PAA)_{10}$ films.

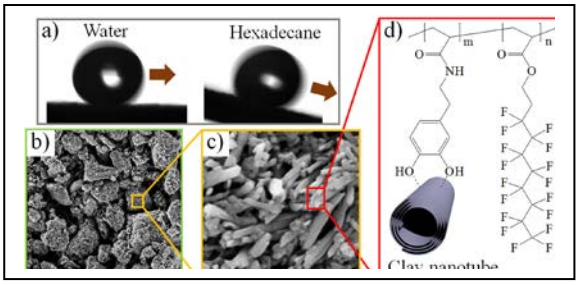

Fig. 2. (a) Images of water and hexadecane droplets sliding on HNT based superamphiphobic coating. (b, c) SEM images of P(FAC_8-*co*-DA)-modified HNT coated paper. (d) Chemical structure of P(FAC_8-*co*-DA).

References:

1. W. Ma, H. Xu, and A. Takahara, *Adv. Mater. Interfaces*, 2014, **1**, 1300092.
2. W. Ma, Y. Higaki, A. Takahara, *Adv. Mater. Interfaces,* 2017, 4, 1700907.