

# Molecular Aggregation Structure and Surface Properties of Biomimetic Catechol-Bearing Poly[2-(perfluorooctyl)ethyl acrylate] and Its Application to Superamphiphobic Coatings

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The molecular aggregation structure and surface properties of a catechol-bearing fluoropolymer, P(FAC<sub>8</sub>-*co*-DOPAm), which was synthesized by conventional radical copolymerization of 2-(perfluorooctyl)ethyl acrylate (FAC<sub>8</sub>) and *N*-(3,4-dihydroxyphenethyl)acrylamide (DOPAm) and its application to the superamphiphobic surfaces are presented. The crystallinity of P(FAC<sub>8</sub>-*co*-DOPAm) was lower than that of poly[2-(perfluorooctyl)ethyl acrylate] (PFAC<sub>8</sub>). The perfluoroalkyl ( $R_f$ ) groups were ordered on the surface with CF<sub>3</sub> terminals exposed to air and the  $R_f$  ordering was influenced by thermal history: the thermally annealed film exhibited higher  $R_f$  ordering than the unannealed one. The surface free energy was estimated to be  $\gamma = 7.32 \text{ mJ m}^{-2}$  for both the unannealed and annealed films. Based on contact angle measurement, various interfacial structures of water and oils in accordance with the surface aggregation structure of  $R_f$  groups were proposed. Dewetting of PFAC<sub>8</sub> film at elevated temperature was suppressed by the introduction of catechol groups in the backbone. The degradation temperature of PFAC<sub>8</sub> was improved significantly and the evaporation of low molar mass polymer was inhibited by the introduction of catechol groups under both nitrogen and air atmospheres. The hydrophobicity of the copolymer films could be healed after the surface was damaged by VUV irradiation. This copolymer was used to create superamphiphobic fabrics and halloysite nanotube (HNT) based organic/inorganic hybrid coatings successfully. Wetting behaviors of the superamphiphobic fabrics and coatings both follow the Cassie–Baxter’s wetting model.