Adherent polyacrylate coatings onto (semi-)conductive surfaces by aqueous cathodic electrografting

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The modification of (semi-)conductive surfaces as carbon, metals and silicon by a polymer coating attracts so much interest because it improves the original properties of the inorganic substrate. The aqueous cathodic electrografting of acrylic monomers is a powerful electrochemical process allowing the coating of surfaces by a very adherent polymer film. The key prerequisite is the amphiphilicity of these monomers which accordingly form micelles in water. Under appropriate cathodic potential, the acrylic functions graft onto the working electrode of the system via a radicalar pathway to give the resulting polyacrylate film.

The first studied monomer is acry-C_{10}, i.e., an alkyl chain ended by an ammonium group and an acrylic function. This monomer is successfully electrografted onto carbon and metals as attested by several techniques. From this one, others are reached by modifying either the hydrophilic or the hydrophobic parts of the molecule. In this way, the substitution of one methyl group attached to the ammonium by a PEO chain leads to inorganic surfaces with higher hydrophilicity. Another way to extend the process is to copolymerize acry-C_{10} with non-amphiphilic functional comonomers (fluorinated acrylate, ferrocen-contained acrylate, …). Once the grafting achieved, the resulting coatings exhibit a broad range of properties as bactericidal or proteins repellent.

This preliminary work is thus encouraging because it evidences that (semi-)conductive surfaces can be extensively modified by the mere electropolymerization of amphiphilic acrylates in water. In the future, the coating of inorganic substrates by stimuli-responsive films could be considered simply by adjusting the functionality of the acrylate.