Electrochemical grafting of material surfaces with organic molecules

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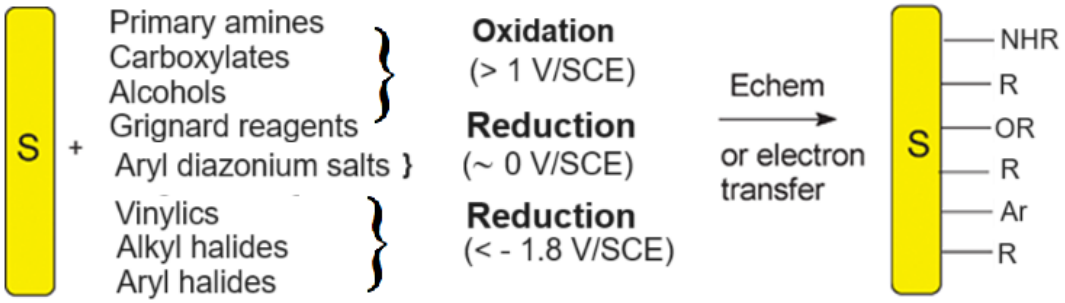
This lecture will give an overview about electrochemical activation of organic molecules that enable the modification of conductor and semi-conductor surfaces. The organic molecules that are prone to be activated either by oxidation or reduction are: primary amines, alkyl carboxylates, Grignard reagents, alcohols, onium salts and alkyl halides. [1] These reactions are performed in aprotic solvents and in the case of the modification of the electrode by oxidation or organic molecules are used electrodes that withstand the oxidation potential higher than 1 V/SCE: carbon, gold, platinum, hydrogenated silicon etc. [2] The grafted films, of varying compositions and thicknesses, are strongly attached to the surface of the material and are stable under various environmental conditions. These attached layers may impart a high number of surface properties such as wettability, adhesion, corrosion protection, microelectronics and molecular electronics, biomedical engineering etc.
The electrochemical grafting of aryl diazonium salts is considered as most effective method for modification of materials surfaces. [3] These compounds are easy synthesized and their reduction reaction can be carried out in aprotic and aqueous solution, allowing the formation of the aryl radicals. These highly reactive species attack the material and nanomaterial surface including graphene, carbon nanotubes, gold nanoparticles and form a strong covalent bond. Aryl species carry numerous reactive functional groups which enable them to be used as coupling agents to bind biomolecules, nanoparticles, polymers and other species to previously grafted surface. [4,5]



Scheme 1. Modification of electrode surface by the electrochemical activation of organic molecules. [2]
S – carbon, metals including coinage metals, Semiconductors, Polymers

References

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