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Self-assembled Monolayers of Aliphatic Thiol, Dithiol and Dithiocarboxylic Acid on Electrochemically Reduced Polycrystalline Copper Substrates

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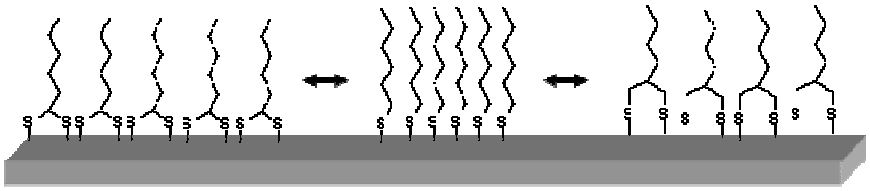
Abstract – Self-assembled monolayers (SAMs) of *n*-alkanethiol (RSH) on polycrystalline copper have been extensively studied. This work affords two major progresses in this field. This first one consists in the use of bipode molecule to modify the stability of the coating. The second progress consists of adsorption those molecules under potential to provide a better control of the interface and a faster grafting.

Copper is an important metal in the chemical and microelectronics industries due largely to its high thermal and electric conductivities and low cost. There are two major disadvantages in the use of copper, the presence of copper oxide on his surface and the corrosion of this metal, especially in aqueous environments [1].

Self-assembled monolayers on copper have been found to be promising inhibitor for copper corrosion. The presence of copper oxide layer on the top is problematic for the thiol adsorption. Chemical and/or electrochemical pretreatment are thus necessary [2]. The alkanethiol monolayers have been show to form oriented densely packed films, which produce effective barriers to the penetration of corrosive chemicals to the substrate and to limit the oxidation of the substrate metal [3].

The present work affords two major progresses in the field of SAMs derivated on alkanethiol on copper. The stability of the coating can be modified by the use of bipode molecule. The aliphatic dithiocarboxylic afford a coating less stable than normal alkanethiol [4]. This kind of coating could be useful for temporary coating. The dithiol, for its part, afford a higher stability than alkanethiol, which is essential for further applications [5]. The second progress consist of adsorption those molecules under potential [6]. This technique involves a better control of the interface and the grafting is faster.



Our study will be carried out by localized (SECM) and conventional (CV, LSV) electrochemistry. The homogeneity of the different monolayers will be studied by scanning the surface in feedback mode. On the basis of the approach curves, we will be able to distinguish the efficiently of the different monolayers using their insulating properties. This property gives us interesting information about the organization of the SAM and the presence of some defect. These results will be compared with cyclic voltammetry measurements. Spectroscopic investigations (XPS and PM-IRRAS) and contact angle goniometry are helpful to evaluate to copper/monolayer interface and the molecular film organization.

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