Insights from SECM and DFT calculations regarding the interaction of oxygen bubbles onto bare and modified gold surfaces

Veton Haziri[1]
Jean François Boily[2]
Avni Berisha[1]

[1] University of Prishtina, Prishtina, Republic of Kosovo
[2] Department of Chemistry, Umeå University, Umeå, Sweden

veton.haziri@ubt-uni.net

Abstract

The utilization of aryl radicals generated during the de-diazotization of aryldiazonium salts to modify/functionalize a variety of surfaces is seen as a straightforward and versatile technique[1]. In comparison to other methods of surface modification [2], it remains one of the most efficient methods of surface modification. The diazonium salts have been considered as simple and efficient coupling agents between surface and functional species in the majority of research studies. Another significant point that makes this approach attractive for surface modification processes is the extraordinary stability of the covalently bonded multilayer structure formed once the aryl moieties are attached to the electrode surface.

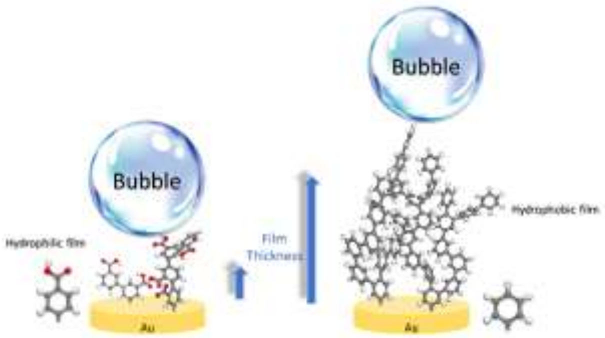

Figure 1. Schematics representing the oxygen bubble on top of the gold surface by phenyl or carboxyphenyl layers.

The covalently grafted 2D Carboxyphenyl (CP) or phenyl layers on the gold Surface (Figure 1), derived from their corresponding diazonium salts, were investigated in this study as a tunable gateway for ion exchange between gas bubble and the modified surfaces. Bubbles and microbubbles are attractive possibilities for future practical applications because they enable the exploration of the electrical properties of the gas–water interface using a variety of measurement techniques. Gas bubbles may play a role in a variety of biogeochemical cycles and in renewable energy studies since they are formed by electrochemical reactions. They are involved in different processes including photo-assisted water splitting reactions[3] , in the fabrication of gas sensing electrodes, foam fractionation, food processing, and purification processes.

References

[1] Berisha, A., Chehimi, M. M., Pinson, J. & Podvorica, F. I. Electrode Surface Modification Using Diazonium Salts. in *Electroanalytical Chemistry* 115–224 (CRC Press, 2015). doi:doi:10.1201/b19196-4.

[2] Love, J. C., Estroff, L. A., Kriebel, J. K., Nuzzo, R. G. & Whitesides, G. M. Self-assembled monolayers of thiolates on metals as a form of nanotechnology. *Chemical Reviews* vol. 105 1103–1169 (2005).

[3] Zhang, J. *et al.* Serial microbubble imaging technology (sMBI) for rapid screening of hydrogen-evolution materials used in photocatalytic water-splitting reactions. *Anal. Methods* **9**, 1835–1838 (2017).