

RESEARCH OUTPUTS / RÉSULTATS DE RECHERCHE

Electro-assisted formation of organothiols self-assembled monolayers on polycrystalline copper surfaces

Maho, Anthony; Denayer, Jessica; Delhalle, Joseph; Mekhalif, Zineb

Publication date:
2011

Document Version
Peer reviewed version

[Link to publication](#)

Citation for published version (HARVARD):

Maho, A, Denayer, J, Delhalle, J & Mekhalif, Z 2011, 'Electro-assisted formation of organothiols self-assembled monolayers on polycrystalline copper surfaces', ElecNano4- 7th ECHEMS, Paris, France, 23/05/11 - 26/05/11.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

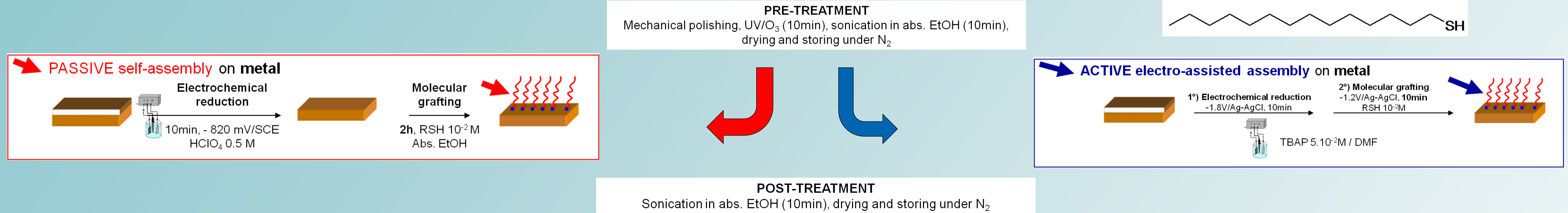
Electro-assisted formation of organothiols self-assembled monolayers on polycrystalline copper surfaces

Anthony Maho, Jessica Denayer, Joseph Delhalle, Zineb Mekhalif
 Laboratory of Chemistry and Electrochemistry of Surfaces (CES)
 University of Namur (FUNDP), Belgium
 Contact: zineb.mekhalif@fundp.ac.be

General context: organothiols films grafted on copper

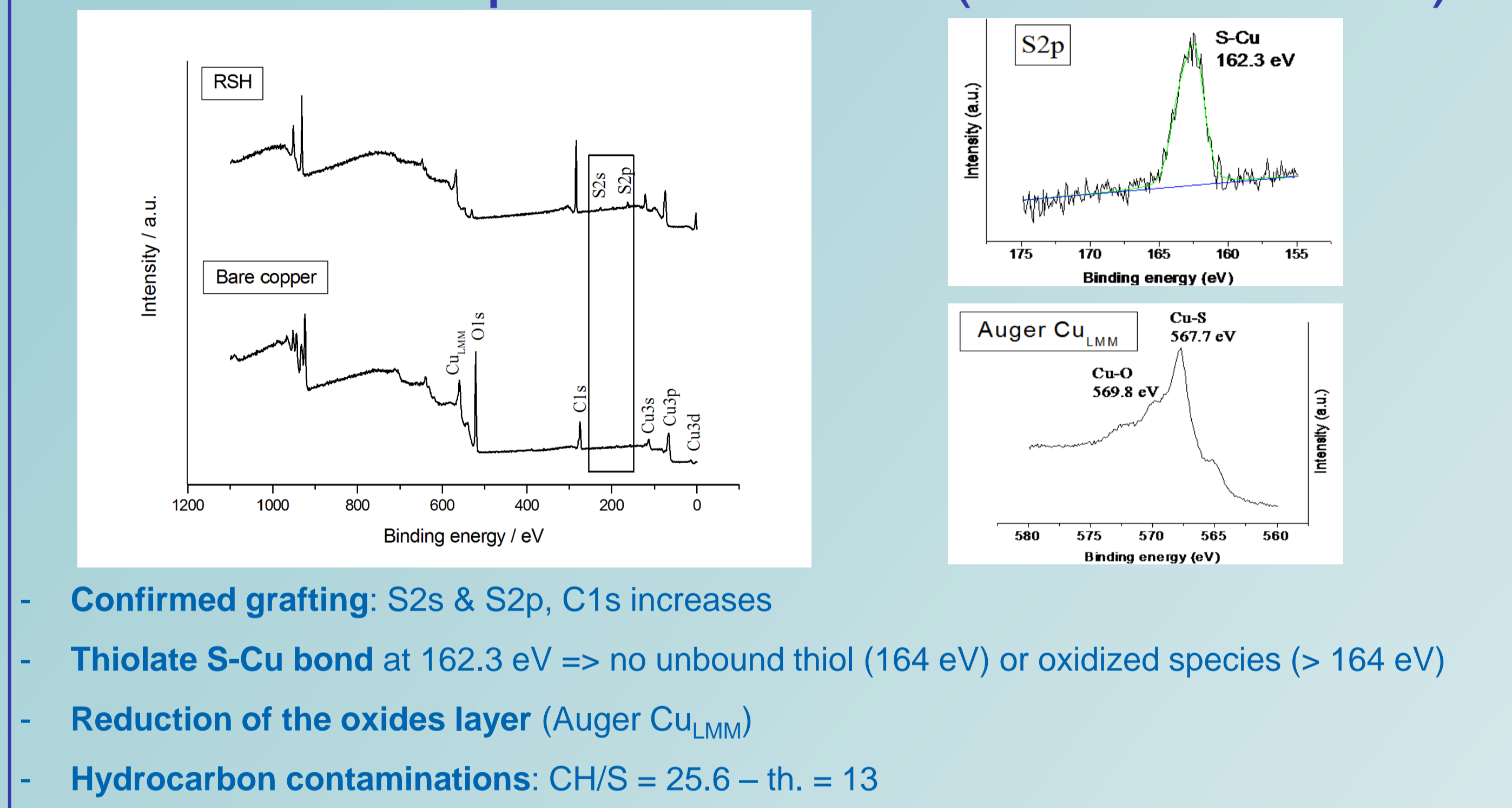
- **Organothiol Self-Assembled Monolayers (SAMs)** can be successfully adsorbed on noble (Au) and **oxidizable metals** (Cu, Zn, Ni). They can be used as protective coatings against corrosion, lubricants, lithographic patterns, molecular (bio)sensors, ... [1]
- **Oxidation state of the substrate surface** is a key factor for the SAMs formation => an **electrochemical reduction pretreatment of the Cu oxides layer** can be exploited to form **reproducible high quality films** [2].
- **Molecular adsorption process** has an important impact on the SAMs characteristics: **passive self-assembly** (open circuit potential) vs. **active electro-assisted assembly** (cathodic polarization of Cu) [3].

Two experimental approaches and methodologies

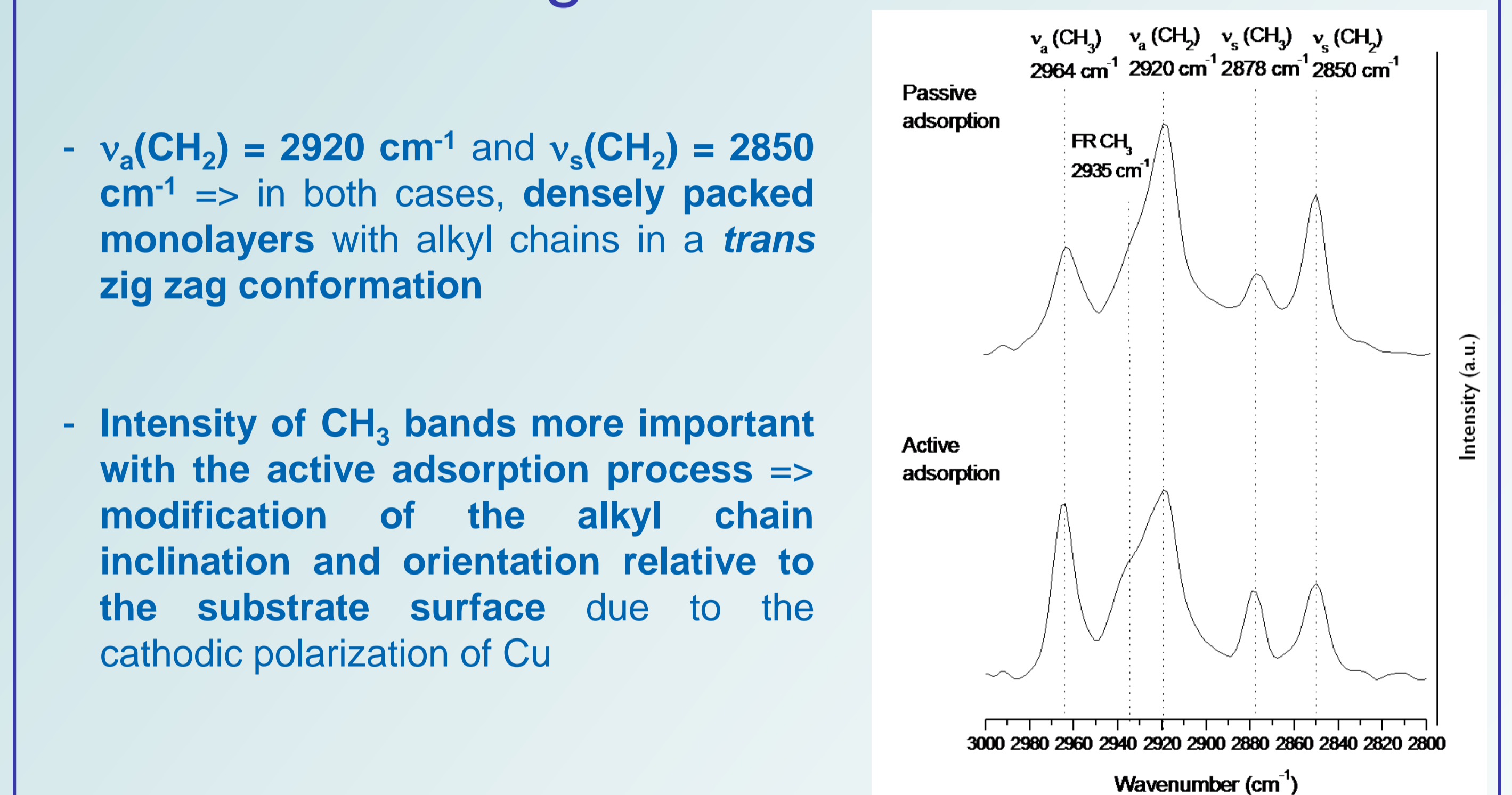


Results and discussion

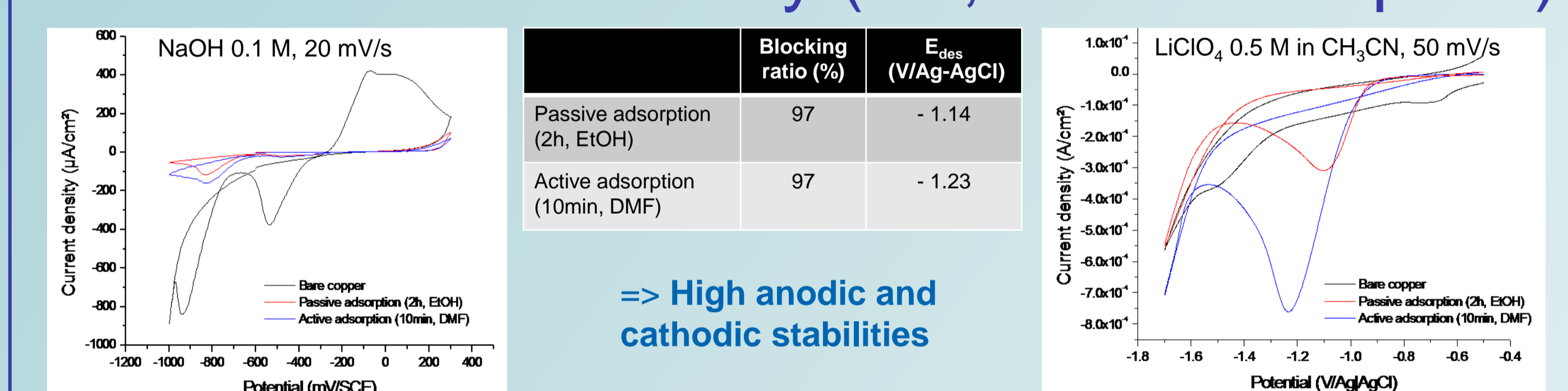
Chemical composition: XPS (active method)



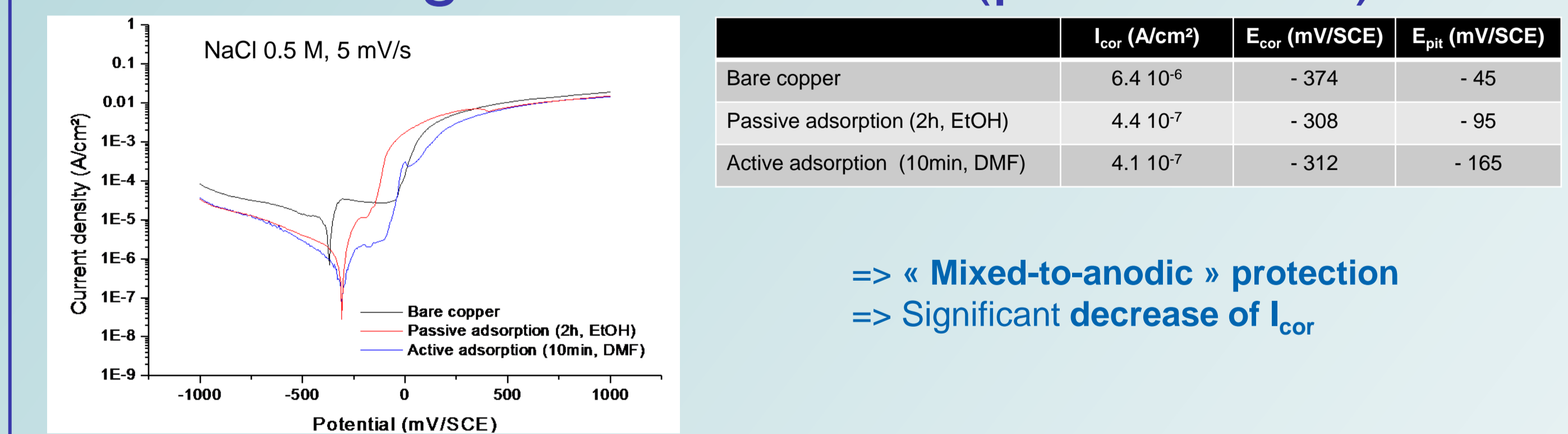
Structure and organization: PM-IRRAS



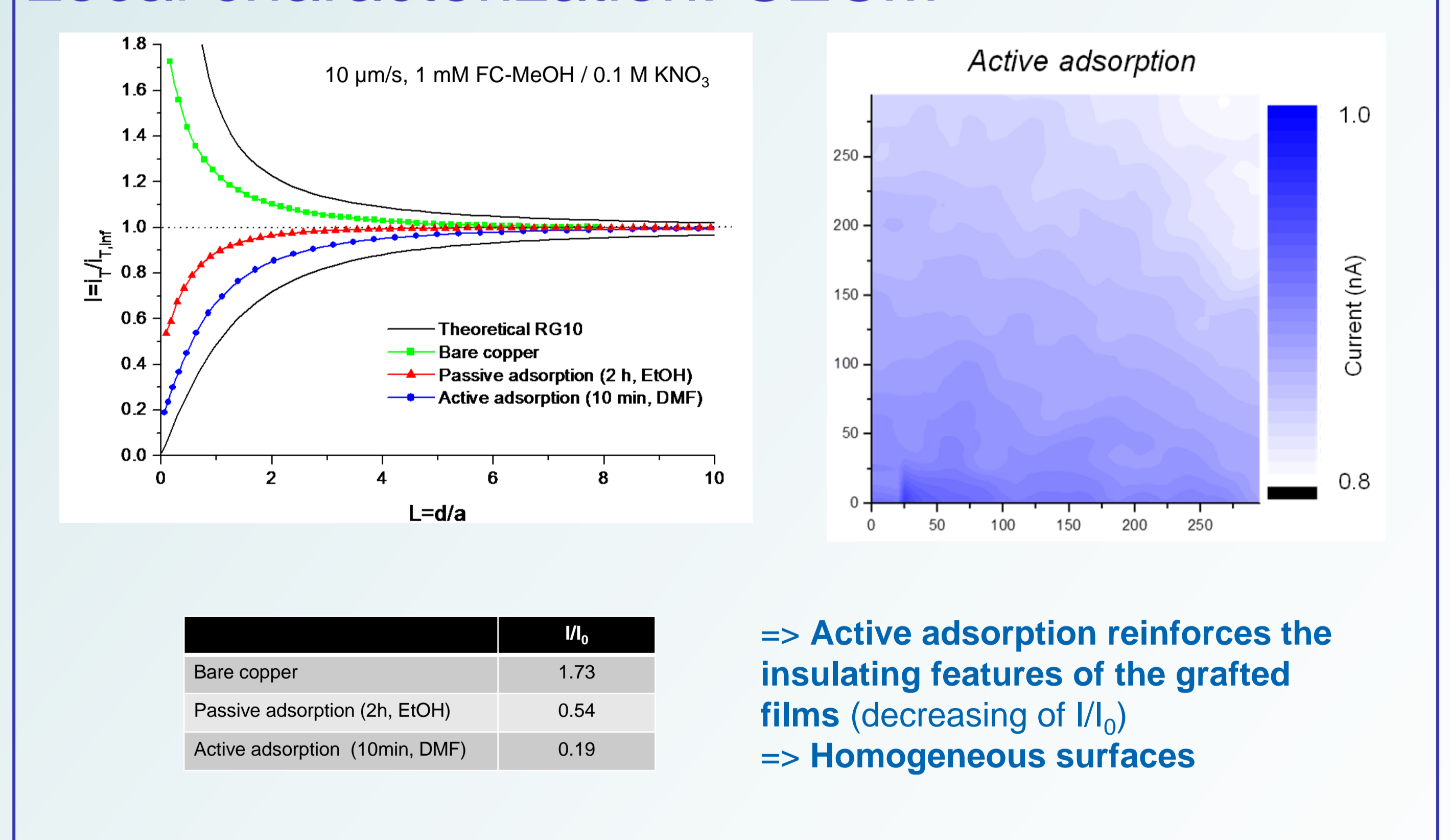
Electrochemical stability (CV, cath. desorption)



Protection against corrosion (pol. curves)



Local characterization: SECM



Conclusions and perspectives

- Efficiency of **active electro-assisted adsorption of organothiols on copper** => formation of SAMs with **excellent properties of organization, protective against corrosion, with high electrochemical stability**, and formed with a **significant saving of time** comparatively to the *passive* methodology (10min vs. 2h).
- Perspectives: variation and optimization of experimental conditions with other substrates and surfactants [3], use of ionic liquids (to reduce hydrocarbon contaminations), ...

References

- [1] P.E. Laibinis, G.M. Whitesides, D.L. Allara, Y.T. Tao, A.N. Parikh, R.G. Nuzzo, *J. Am. Chem. Soc.* **1991**, *113*, 7152-7167; G. Fonder, F. Laffineur, J. Delhalle, Z. Mekhalif, *J. Colloid. Interf. Sci.* **2008**, *326*, 333-338.
- [2] Z. Mekhalif, F. Sinapi, F. Laffineur, J. Delhalle, *J. Electron. Spectrosc.* **2001**, *121*, 149-161; J. Denayer, J. Delhalle, Z. Mekhalif, *J. Electroanal. Chem.* **2009**, *637*, 43-49; G. Fonder, C. Volcke, B. Csoka, J. Delhalle, Z. Mekhalif, *Electrochim. Acta* **2010**, *55*, 1557-1567.
- [3] A. Maho, J. Denayer, J. Delhalle, Z. Mekhalif, *Electrochim. Acta* **2011**, *56*, 3954-3962.