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Electrochemistry for renewable energy studies: the case of WO_3 photoanodes and of organic semiconducting films

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Electrochemistry is a powerful tool in the modern research. Its polyhedral nature makes this ensemble of techniques unique, not only in term of operating conditions (switching from synthetic to characterization methods), but also for the great ductility in the applications (including molecules in solution, solid films/coatings, and even working devices). Other important aspects are that characterizations can be performed *i*) *in situ*/*in operando*, a great advantage to understand how a material actually behaves in the devices, and *ii*) in combination with other techniques, enriching the portfolio of information coming from a multi-stimuli approach.
In this presentation examples of very recent studies in the field of renewable energies will be discussed, focusing on WO_3-based photoanodes and "smart" organic semiconductors.
A peculiar bilayer architecture of WO_3 coatings, obtained by radio frequency plasma sputtering, revealed remarkable photoelectrocatalytic performance neatly overcoming the main key parameters of control materials properly prepared. Electrochemical studies played a crucial role in the clarification of such behavior [1].
The second example concerns a study in progress as part of a broader project focused on a very promising class of inherently chiral organic semiconductors, acting as efficient and robust enantioselective layers for electrochemical sensors [2,3]. Such innovative materials seem to be exploitable also for other applications, including energetics. A deep and multivariate characterization is mandatory to reveal as much properties as possible that could be finally combined to depict a complete portrait of these conducting organic films. In particular an imaginary journey from the outside (*i.e.* surface area) to the inside (*i.e.* optical and electronic features) will be made.

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References

[1] Chiarello, G. L.; Bernareggi, M.; Pedroni, M.; Magni, M.; Pietralunga, S. M.; Tagliaferri, A.; Vassallo, E.; Selli, E. *J. Mater. Chem. A* **2017**, *5*, 12977.
[2] Sannicolò, F.; Mussini, P.R.; Benincori, T.; Martinazzo, R.; Arnaboldi, S.; Appoloni, G.; Panigati, M.; Quartapelle Procopio, E.; Marino, V.; Cirilli, R.; Casolo, S.; Kutner, W.; Noworyta, K.; Pietrzyk-Le, A.; Iskierko, Z.; Bartold, K. *Chem. Eur. J.* **2016**, *22*, 10839.
[3] Arnaboldi, S.; Benincori, T.; Cirilli, R.; Kutner, W.; Magni, M.; Mussini, P.; Noworyta, K.; Sannicolò, F. *Chem. Sci.* **2015**, *6*, 1706.