



GEI 2013

ATTI DEL CONVEGNO



GEI 2013

Giornate dell'Elettrochimica Italiana  
22 - 27 Settembre 2013, Pavia



GEI 2013

GEI 2013

Giornate dell'Elettrochimica Italiana

22 - 27 Settembre 2013, Pavia

## NEW ELECTROCHEMICAL MICROFLUIDIC DEVICES FOR THE SYNTHESIS OF CHEMICALS AND THE TREATMENT OF WASTE WATERS

O. Scialdone, S. Sabatino, M. Vaiana, S. La Mantia, C. Guarisco

Università degli Studi di Palermo, Dipartimento di Ingegneria Chimica, Gestionale, Informatica, Meccanica, Viale delle Scienze, Palermo

e-mail: onofrio.scialdone@unipa.it

Electrochemical methods can offer new sustainable routes for both the synthesis of chemicals and the treatment of waste waters contaminated by organic pollutants resistant to biological processes. Indeed, these methods use a clean reagent, the electron, and very mild operative conditions (ambient temperature and atmospheric pressure) with limited operative costs. However, electrochemical processes present some important disadvantages when performed in conventional reactors. In particular, to achieve reasonable cell voltages when the medium has not an adequate conductivity, one needs adding to the system a supporting electrolyte. This is certainly a main obstacle for a wide application of electrochemical tools. Indeed, adding chemicals is often a problematic issue, since this may lead to the formation of secondary products, makes more difficult the separation procedures and increases the operative costs. Microcells (e.g. cells with a distance between the cathode and the anode of tens or hundreds of micrometers) lead to a drastic reduction of the ohmic resistances, thus allowing electrochemical operation without supporting electrolyte. Similarly, very small distances between electrodes spontaneously intensifies mass transport of the reagents towards electrodes surfaces. Finally micro devices may simplify the scale-up procedure, since this only requires a simple parallelization of many small units. In the present work we have developed two new types of microfluidic devices [1-3]. Some model processes of synthesis of fine chemicals and electrochemical abatement of pollutants were studied in both conventional and microfluidic cells in order to highlight advantages and disadvantages given by the utilization of such devices.

[1] C. A. Paddon, M. Atobe, T. Fuchigami, P. He, P. Watts, S. J. Haswell, G. J. Pritchard, S. D. Bull, F. Marken, *J. Applied Electrochem.* (2006) 36, 617; P. He, P. Watts, F. Marken, S. J. Haswell, *Electrochem. Comm.* (2005) 7, 918.

[2] O. Scialdone, C. Guarisco, A. Galia, G. Filardo, G. Silvestri, C. Amatore, C. Sella, L. Thouin, *J. Electroanal. Chem.* (2010) 638, 293; O. Scialdone, A. Galia, C. Guarisco, *Electrochim. Acta* (2011) 58, 463.

[3] O. Scialdone, A. Galia, C. Guarisco, S. La Mantia, *Chemical Engineering Journal* (2012) 229, 189.