XXXVII
Reunión del Grupo de Electroquímica
Alicante, 17-20 Julio 2016

Proprioceptive Artificial Muscles

Victor H. Pascual Carrion

Centre for Electrochemistry and Intelligent Materials (CEMI), Universidad Politécnica de Cartagena (UPCT), Aulario II, E-30203, Cartagena, Spain
E-mail: victor.pascual@upct.es

One of the dreams of engineers and robot designers is the design and construction of sensing motors mimicking haptic muscles. In this search for dual sensing-motors [1,2] electrochemical artificial muscles sense, through the consumed energy, chemical and physical working conditions. They only need two wires to transmit both, the sensing and the actuating information, between the tool and a control system [3]. Driven by oxidation/reduction reactions conducting polymers suffer reversible volume changes leading to bending or linear motion [4]. While moving the evolution of the muscle potential and the consumed energy sense energetic working conditions [5] as temperature [6], concentration [7] presence of obstacles.
Our aim is to develop dual and simultaneous sensing-actuators from different materials working for thousand of cycles. Thus, one motor and several sensors (thermal, chemical, mechanical, electrical) will work simultaneously in a physically uniform device driven by the same electrochemical reaction. Different families of conducting polymers, exchanging anions or cations during reaction will be checked. The theoretical description of artificial proprioception [7] will be improved to implement a control system getting artificial proprioceptive tools.

ADVISERS/MENTORS
Toribio F. Otero. Centre for Electrochemistry and Intelligent Materials (CEMI), Universidad Politécnica de Cartagena (UPCT), Aulario II, E-30203, Cartagena, Spain. Email: Toribio.fotero@upct.es

Acknowledgements:
This project is funded by the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 641822.

References:
[1] T. F. Otero and J. G. Martinez, "Physical and chemical awareness from sensing polymeric artificial muscles. Experiments and modeling," *Progress in Polymer Science*, vol. 44, pp. 62–78, May 2015.
[2] T. f. Otero and J. g. Martínez, "Artificial Physical and Chemical Awareness (Proprioception) from Polymeric Motors," in *Symposium A – Organic Bioelectronics*, 2015, vol. 1717, pp. mrsf14–1717–a02–01 (12 pages).
[3] T. F. Otero, "Biomimetic Conducting Polymers: Synthesis, Materials, Properties, Functions, and Devices," *Polymer Reviews*, vol. 53, no. 3, pp. 311–351, Jul. 2013.
[4] T. F. Otero and J. G. Martinez, "Artificial Muscles: A Tool To Quantify Exchanged Solvent during Biomimetic Reactions," *Chem. Mat.*, vol. 24, no. 21, pp. 4093–4099, Nov. 2012.
[5] J. G. Martinez and T. F. Otero, "Mechanical awareness from sensing artificial muscles: Experiments and modeling," *Sens. Actuator B-Chem.*, vol. 195, pp. 365–372, May 2014.
[6] T. F. Otero, J. J. Sanchez, and J. G. Martinez, "Biomimetic Dual Sensing-Actuators Based on Conducting Polymers. Galvanostatic Theoretical Model for Actuators Sensing Temperature," *Journal of Physical Chemistry B*, vol. 116, no. 17, pp. 5279–5290, May 2012.
[7] J. G. Martinez and T. F. Otero, "Biomimetic Dual Sensing-Actuators: Theoretical Description. Sensing Electrolyte Concentration and Driving Current," *J. Phys. Chem. B*, vol. 116, no. 30, pp. 9223–9230, Aug. 2012.