Next generation of ionic transport control in nanofluidics by integration of conductive polymers into asymmetric solid-state nanopores. Insights from theory and experiments

Abstract: During the past decade there have been large advances in nanofluidics due to the fact that the scientific community has fully acknowledged the importance of this field for controlling the transport of ionic species in miniaturized devices. In this presentation, I will show our recent experimental and theoretical results about how the regulation of the surface charge density and distribution allows modifying the permselectivity and consequently the conductance of solid-state nanopores showing both ohmic (ionic resistor) and non-ohmic (ionic diodes) behaviors. Furthermore, I will discuss our recent results on integrating conductive polymers within solid-state nanopores using different synthetic approaches offering new possibilities for developing electrochemically-controlled nanofluidic devices and conversely, the possibility of obtaining physical and chemical information of conductive polymers such as electrochemical state, surface charge or acid-base equilibrium by studying the nanofluidic output.

Some of the results to be discussed in this talk can be found in these publications:

Gonzalo Pérez-Mitta, Alberto Gustavo Albesa, Facundo Matías Gilles, Maria E. Toimil-Molares, Christina Trautmann, and Omar Azzaroni. A Noncovalent Approach Towards the Construction of Nanofluidic Diodes with pH-Reversible Rectifying Properties - Insights from Theory and Experiment. J. Phys. Chem. C, 2017, 121, 9070-9076.

Gonzalo Pérez-Mitta, Alberto G. Albesa, María E. Toimil Molares, Christina Trautmann and Omar Azzaroni. The Influence of Divalent Anions on the Rectification Properties of Nanofluidic Diodes: Insights from Experiments and Theoretical Simulations. ChemPhysChem, 2016, 17, 1 – 9.

Gonzalo Pérez-Mitta, Waldemar A. Marmisollé, Christina Trautmann, María Eugenia Toimil-Molares and Omar Azzaroni. Nanofluidic Diodes with Dynamic Rectification Properties Stemming from Reversible

Electrochemical Conversions in Conducting Polymers. J. Am. Chem. Soc. 2015, 137, 15382-15385.