# Exploiting the interfacial properties of ion-exchange polymers: from fundamental aspects to the development of self-propelled micro/nanosystems

**M.J. Esplandiu[1],** D. Reguera[2,3], J. Fraxedas[1]

[1]Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and BIST, Campus UAB, Bellaterra, 08193 Barcelona, Spain.

[2]Departament de Física de la Matèria Condensada, Universitat de Barcelona, C/Martí i Franquès 1, 08028 Barcelona, Spain.

[3]Universitat de Barcelona, Institute of Complex Systems (UBICS), C/Martí i Franquès 1, 08028 Barcelona, SpainAuthor

Mariajose.esplandiu@icn2.cat

Ion-exchange polymers such as Nafion exhibit surprising interfacial phenomena. One of the most striking one is the formation of a long-range solute exclusion zone (EZ) in contact with water. The mechanism of such EZ formation has been the subject of a controversial and long-standing debate with explanations rooted either on the interfacial water structuration that excludes solutes[1] or on the ion-exchange process itself which generates ion diffusion/ion gradients, driving solute repulsion by diffusiophoresis[2].

Combining different experimental techniques, theory, and simulation, we show that multi-ionic diffusiophoresis is indeed the mechanism explaining the formation of the EZ. We have also found that an electric field built-up during the ion-exchange process is a key player in the EZ formation[3]. Such electric field, pointing towards Nafion, arises due to the different ion mobilities during the ion-exchange process and can be tailored to develop self-propelled pumps and swimmers of high interest in biomedical and nanotechnological applications. These ion-exchange machines have many advantages: they can use salts as fuel, are reusable and can work at high salt concentrations. In addition, we will show how a proper micro/nanostructuration of Nafion can be used to guide flows in arbitrary directions[4]. Finally, we will demonstrate the potentialities of taming these systems to applications in water remediation.

## REFERENCES

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