



Ionogels for Energy Storage : the Determining Effect of the Interface

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Ionogels represent a route to biphasic materials, for the use of ionic liquids (ILs) for all-solid devices. Confining ILs within host networks enhances their averaged dynamics, resulting in improved charge transport. Fragility, short relaxation times, low viscosity, and good ionic conductivity, all them appear to be related to the IL / host network interface. The presence of ILs at interface neighborhood leads to the breakdown of aggregated, structured regions that are found systematically in bulk ILs. This “destruction”, as well as segregative interactions at interface, coupled with percolation of the bicontinuous solid/liquid interface, make these materials very competitive solid electrolytes, since they could provide (i) a route to lower locally the viscosity of ILs, and (ii) an easier path for diffusion of charged species. Several types of ionogels demonstrate this effect: the host networks studied range from fully inorganic to hybrid, polymeric, organic-inorganic matrices. This general approach can be applied to several all-solid devices, including lithium batteries (Fig 1, [1]) and supercapacitors (Fig. 2, [2]). Overall high performances were shown on these last two devices, along with the advantageous intrinsic, sometimes heightened, properties of the chosen ILs. Herein we will emphasize the results of a systematic study of the effect of pore size for silica-based ionogels, where pores sizes were finely prepared, beforehand for the sake of this study.

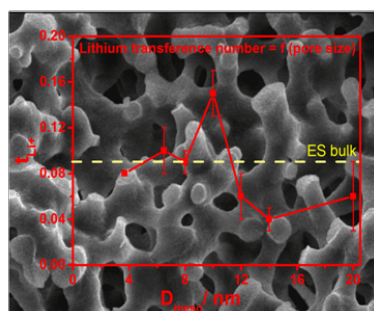


Figure 1. Lithium transport number shows an optimum for a given pore size.

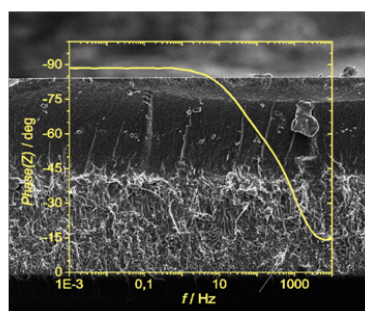


Figure 2. Solid SCap time response is as high as SCap with non confined ionic liquid.

References

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2. M. Brachet, D. Gaboriau, P. Gentile, S. Fantini, G. Bidan, S. Sadki, T. Brousse, J. Le Bideau, *J. Mater. Chem. A*, 4, 11835-11843, (2016).

Contribution:

Invited