Ionic Conductive Bio-based Composite Aerogel as a separator for electrochemical devices

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Significant advancements are required in the energy transition process. The goal is not only to improve the performance of energy storage systems but also to enhance their sustainability and safety, and so reducing environmental and social impacts. Aerogels, which are lightweight and low density materials with high mechanical strength, good thermal and electrical insulation properties and, flame resistance, are particularly appealing for such applications. These characteristics align with the fundamental requirements of an efficient separator, which is essential for efficiently maintaining electrode separation, withstanding high temperatures, and preventing short circuits. Additionally, its compatibility with the electrolyte, influence on ionic conductivity and the electrodes wettability are equally important for the final performance of the device. To further promote a green energy transition, and reduce dependence on petroleum-based materials, it is also possible to develop eco-friendly aerogels derived from biobased sources. This study presents the synthesis of a biobased aerogel composed of alginate, montmorillonite clay, and tannic acid, using only water as a solvent. This aerogel was "activated" in terms of ionic conduction by infiltrating a solid polymer electrolyte (SPE) based on polyethylene glycol 8000 (PEG 8k) and Lithium bis trifluoromethanesulfonyl imide (LiTFSI), obtaining a porous coverage. After deposition, the material showed an intrinsic ionic conductivity while keeping an high porosity, obtaining a potential ionic conductive separator for next-generation electrochemical devices.

Key words: Energy transition, aerogels, bio-based material, separator, electrolyte.