2024 International Spring MUSICHEM Conference
Villa Rosa, Anacapri, May 21st 2024

From recycled PVB to innovative separators and binders for Li- and Na-ion Batteries

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Li- (LIBs) and Na-ion batteries (NIBs) play a crucial role as energy storage devices for electric vehicles and smart grids. It's widely recognized that all the components contribute to the overall performances, not only the active materials, but also conductive carbons, current collectors, electrolyte separators and binders, so that the optimization of each component is likely to result into huge economic and environmental benefits [1].

In this context, we explored the possibility of repurposing in batteries the recycled polyvinyl butyral (PVB) from post-consume laminated glasses (from automotive and construction) that cannot be reused in glasses because of degraded optical properties [2]. Indeed, nowadays most of the PVB collected after disposal is incinerated or landfilled, causing tons of losses every year [3].

Two strategies were pursued: either using recycled PVB as binder in the electrodes composition or transforming it into a membrane to be used as electrolyte separator.

In the case of PVB as binder, we investigated the electrochemical and structural properties of polymer blends of PVB with standard binders, as polyacrylic acid (PAA) and poly(vinylidene fluoride) (PVDF), producing hard carbon (HC) anodes for both LIBs and NIBs.

On the other side, the membrane preparation required the conversion of PVB into a cross-linked polyurethane by reaction with a diisocyanate, controlling the morphology of the produced membranes by changing the conditions of the coagulation bath used for their casting [4]. Many parameters must be considered for the preparation of an optimal separator, including electronic insulation, low ionic resistance, mechanical stability, chemical resistance to degradation, wettability and uniform thickness.

Preliminary results are highly encouraging and pave the way to the development of more sustainable separators and binders from waste products for safe, low-cost energy storage devices.

Acknowledgements

The SUNRISE project (https://sunrise-project.eu/) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958243.

References

[1] P. Arora et al., *Chem. Rev.* **2004**, 104, 4419–4462
[2] V. Nikitakos et al., *Polymers* **2024**, 16, 10
[3] F. Duffner et al., *Renewable Sustainable Energy Rev.* **2020**, 127, 10987
[4] F. Lian et al., *J. Memb. Sci.* **2014**, 456, 42–48