

# New binders and separators with recycled PVB: from waste to Li- and Na-ion batteries

A. Piovano, H. Darjazi, M. Falco, S. Porporato, M. Gastaldi, G. Meligrana, G.A. Elia, C. Gerbaldi

GAME Lab, Department of Applied Science and Technology, Polytechnic of Torino, Corso Duca degli Abruzzi 24, 10129, Torino, Italy  
National Reference Center for Electrochemical Energy Storage (GISEL) - INSTM, Via G. Giusti 9, Firenze 50121, Italy  
email: [alessandro\\_piovano@polito.it](mailto:alessandro_piovano@polito.it)

**ABSTRACT:** Polyvinyl Butyral (PVB) is used as the interlayer polymer in laminated glass.

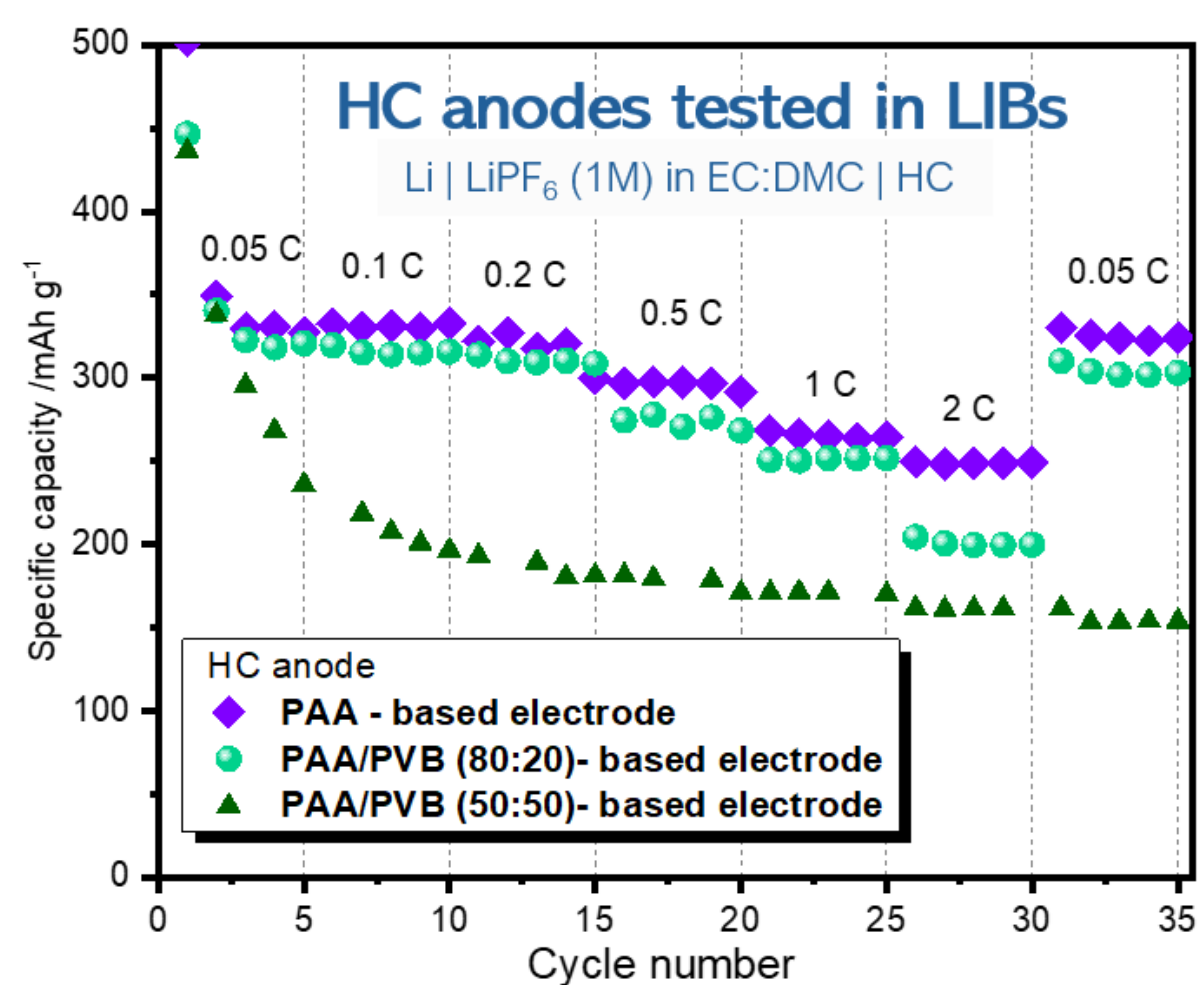
SUNRISE European Project is developing an innovative sorting tool to classify the laminated glasses depending on the composition and quality of PVB layer.

In the framework of the SUNRISE Project, we explored new strategies for revaluing the fraction of recycled PVB not suitable for being reused in laminated glass, repurposing it into energy storage applications (either as binder for electrodes or as electrolyte separator).

## PVB as binder in hard carbon (HC) electrodes

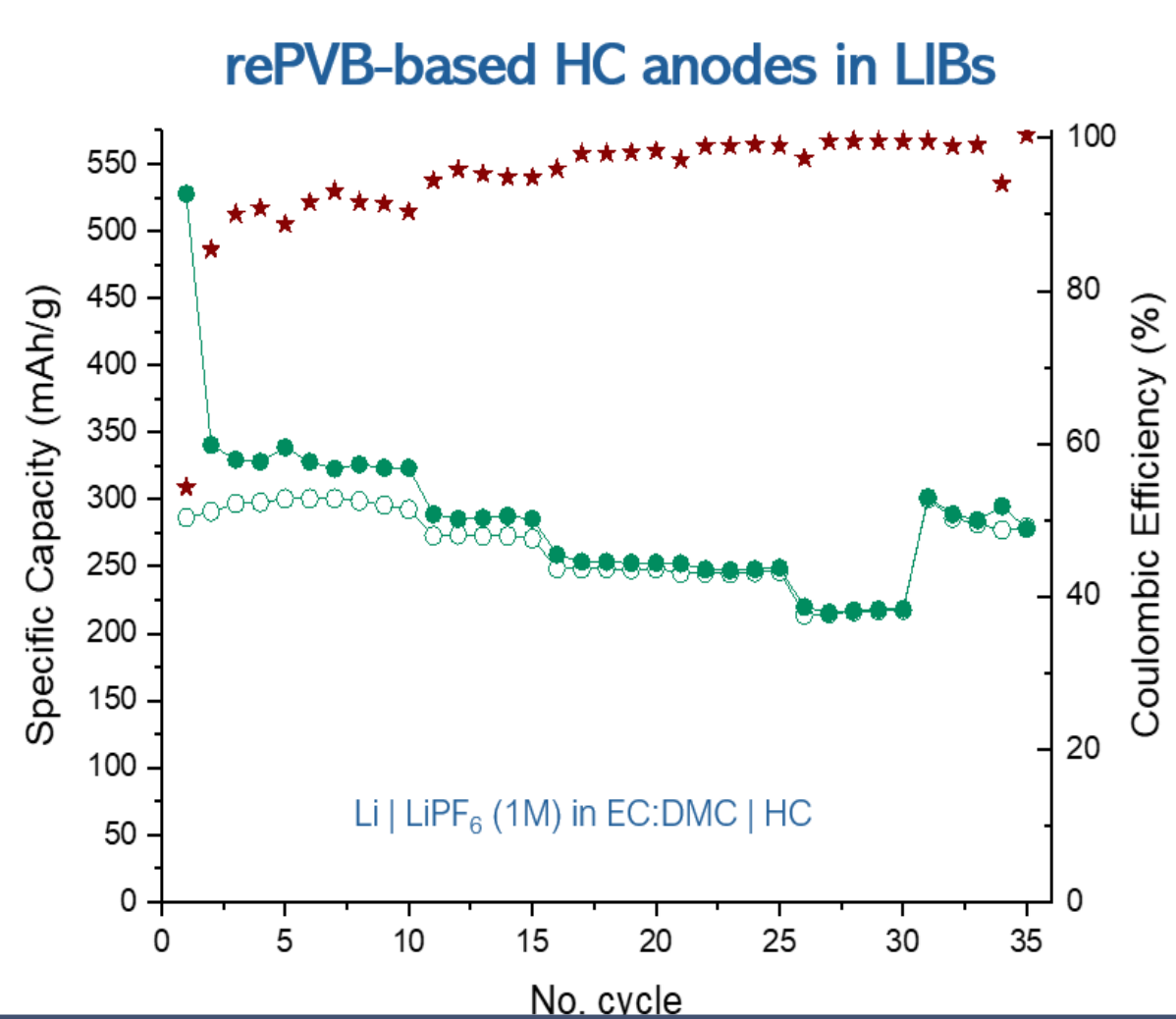
Mix of PVB and standard binder polymers:

- PVDF/PVB (80:20)
- PAA/PVB (80:20 or 50:50)



PAA/PVB (80:20) electrode shows high capacity at different C-rates, with a C.E. of 99.9 %.

Higher percentage of PVB (50:50) causes a drop of capacity.

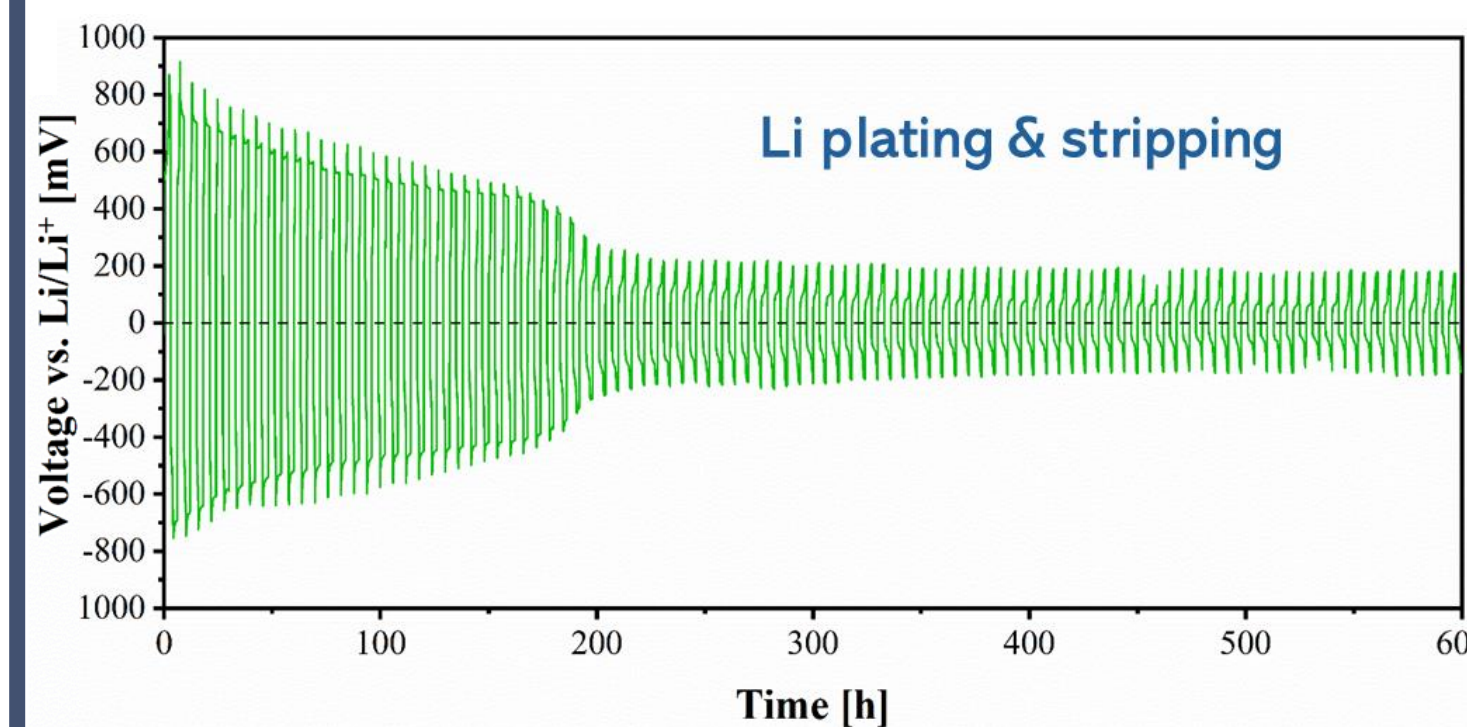
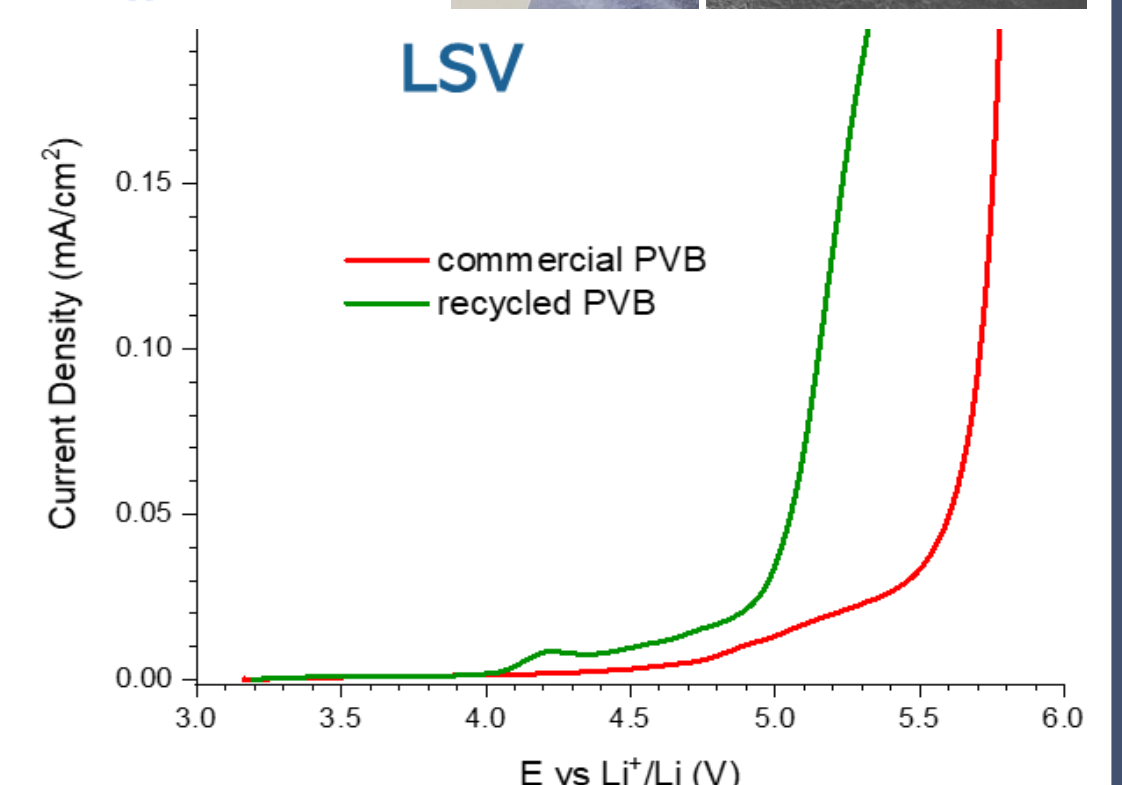
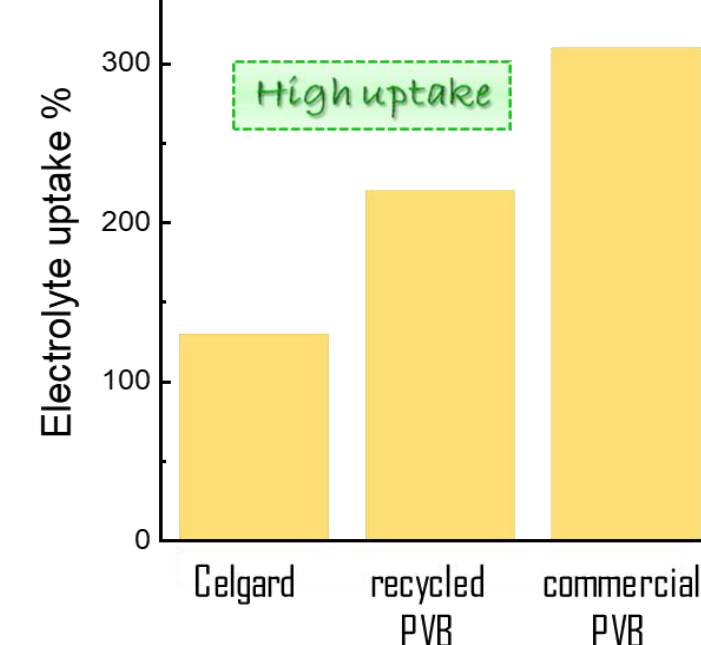
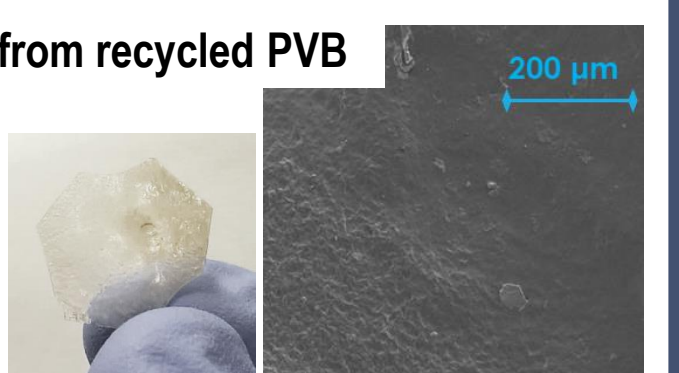
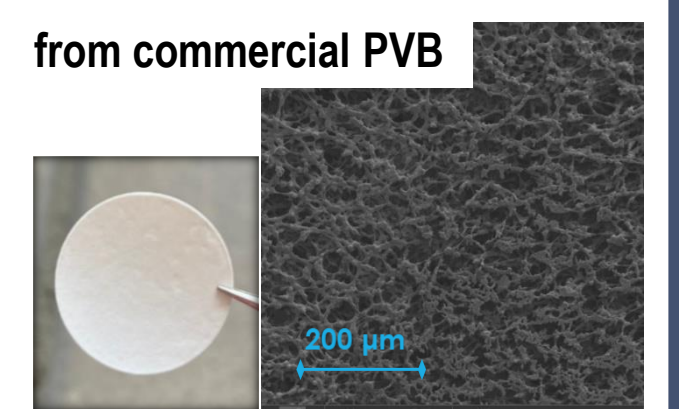
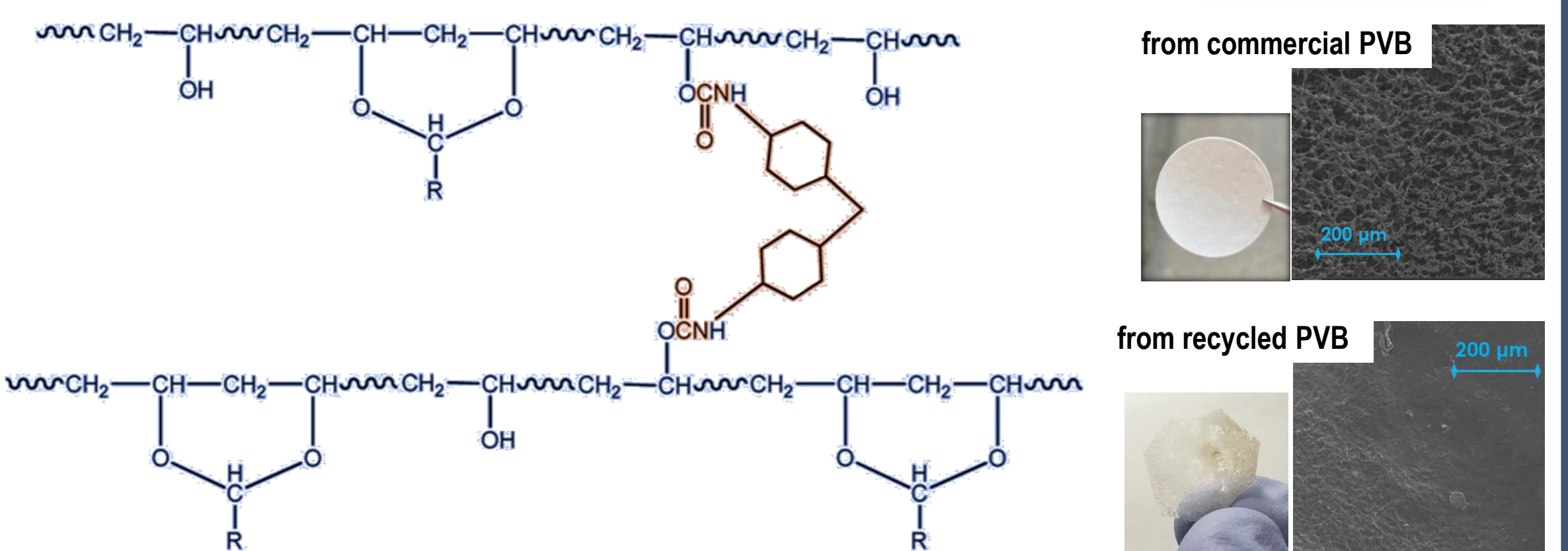


Recycled PVB can be used as well: PAA/rePVB (80:20) displays good rate capability even at high current.

Low initial C.E. because of secondary reactions by polymer "additives", such as plasticizers and undefined contaminants.

## PVB as electrolyte separator

Membranes were obtained by PVB crosslinking with a diisocyanate.



The membrane with pure PVB is stable up to 4.7 V, while in the membrane from recycled PVB the additives start to degrade at lower potentials.

The membranes are compatible with metal Li and stable upon cycling.

## Conclusions

The substitution of a fraction of standard polymer binders with PVB is beneficial for the mechanical adhesion and the stable capability of electrodes.

PVB-based membranes were prepared by cross-linking reaction with a diisocyanate compound and successfully tested as electrolyte separators in Li-ion batteries.

In both cases, the same procedures developed for pristine PVB can be adopted for repurposing the recycled PVB, despite some efficiency limitations due to the presence of plasticizers and contaminants.



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