

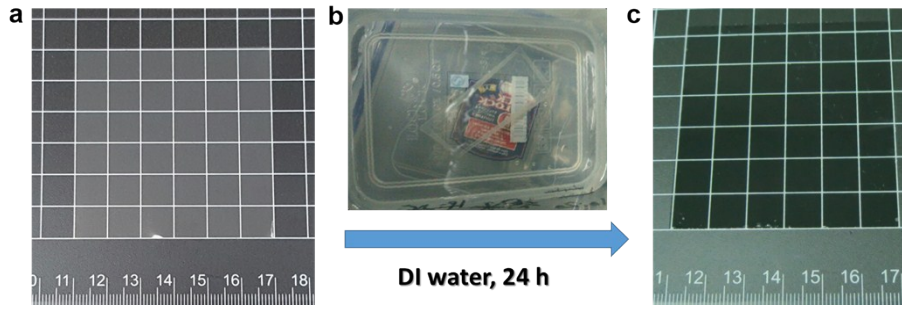
## Electronic Supplementary Information

### **Structure-property relationship study of Nafion XL membrane for high-rate, long-lifespan, and all-climate vanadium flow batteries**

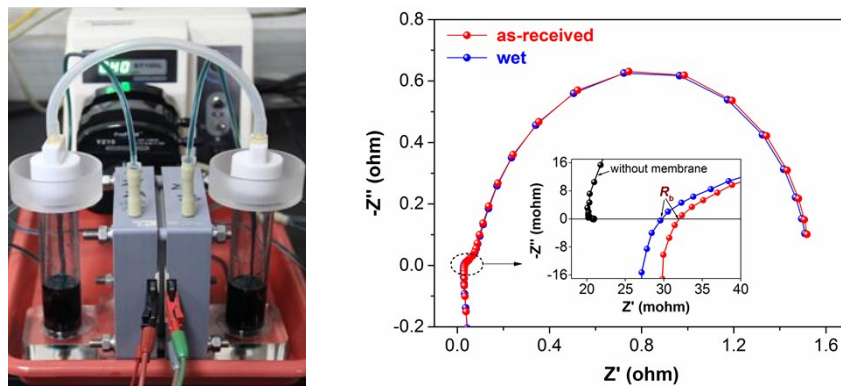
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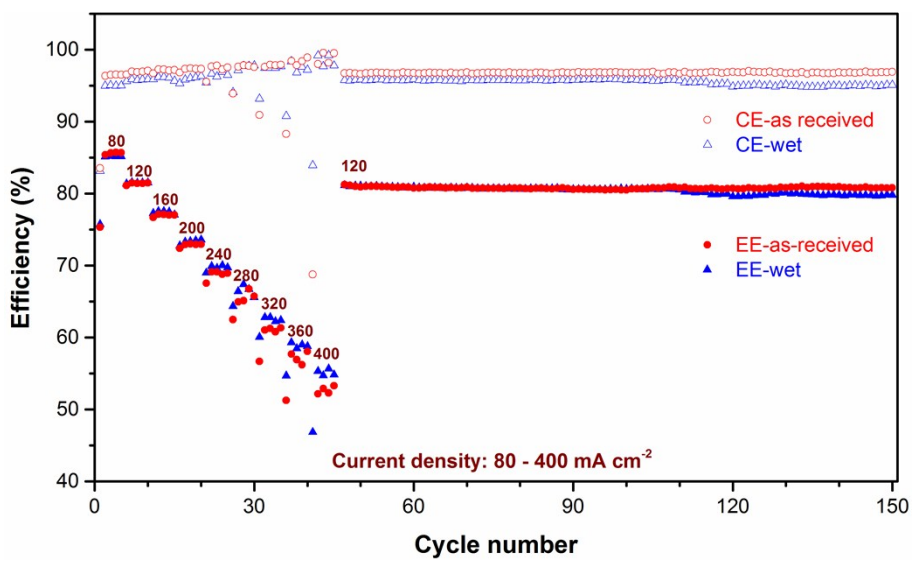
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**Fig. S1.** Photographs of Nafion XL membranes: (a) as-received membrane; (b) immersed in DI water; (c) wet membrane.



**Fig. S2.** Photograph of the VFB single-cell (left) and Nyquist plots of VFBs assembled with as-received and wet Nafion XL membranes (right).



**Fig. S3.** Rate performance and cycling stability of VFBs assembled with as-received and wet Nafion XL membranes.