SUCCESS STORY

CEST
Centre of electrochemical and surface technology

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: NoAge, 2022-2024 single firm

EXTENDING THE LIFETIME OF VANADIUM REDOX FLOW BATTERIES

VANADIUM REDOX FLOW BATTERIES (VRFB) ARE A PROMSING TECHNOLOGY FOR ENERGY STORAGE ON LARGE SCALES. OUR RESEARCH WE PROVIDED UNDERSTANDING FOR THE DEGRADTION MECHANISMS AND DEVELOPED SOLUTIONS TO EXTEND THE LIFETIME OF THOSE BATTERIES.

A key challenge for enabling the sustainable transformation of our energy and industry systems is to increase the generation of renewable electricity (from wind or photovoltaics). An inherent problem with these electricity sources is their fluctuation. To enable further expansion of those technologies, large scale energy storage solutions are urgently required.

Vanadium redox flow batteries (VRFBs) are optimally suited to act as large scale, medium time (hours – days) energy storage system. In contrast to other battery technologies, redox flow batteries, allow the independent scaling of power output and amount of energy stored. They are ideally suited for combination with photovoltaic and wind parks, to balance current peaks and bridge production gaps (e.g., day and night cycles with photovoltaics).

Already with the current VRFB systems, 10000-20000 cycles and lifetimes of 20 years can be achieved. To allow an even broader application of those systems and extend their lifetime and efficiency further, improved battery compounds (electrodes, membranes) with longer lifetime have to be found.

Federal Ministry Republic of Austria Transport, Innovation and Technology

Federal Ministry Republic of Austria Digital and Economic Affairs

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For this purpose, either completely new materials have to be developed or deactivation and degradation mechanisms, reducing the compound and battery lifetime have to be evaluated and understood.

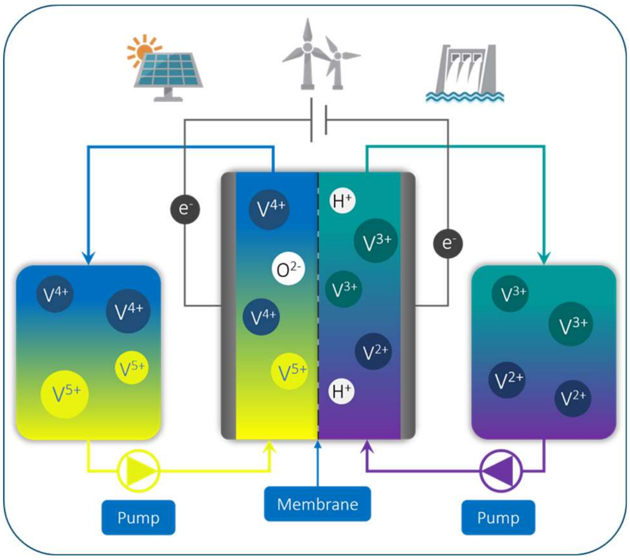
With our industrial partner Enerox, we at CEST we are following both strategies. With our modern and innovative tools for surface analysis, we can gain insight into the atomic structure of electrode and membrane materials and understand the changes in the materials during operation in the battery.

Based on these insights we succeeded to identify the key degradation mechanism on the carbon-based electrodes used in VRFBs. By understanding those degradation mechanisms, we could develop a strategy to regenerate already degraded electrodes in VRFBs. By applying this regeneration strategy, the electrode lifetime can be significantly extended. This reduces the service intervals for batteries and allows a longer lifetime of the whole battery system.

Impact and effects

By extending the lifetime of VRFBs, we could even further increase their economic feasibility and competitiveness.

Although the ecological balance of VRFBs is already very good, the extended lifetime renders it now excellent. All components, such as electrodes, membranes and the Vanadium containing electrolyte are fully recyclable and can be repurposed after the end of battery lifetime.



Schematics of an VRFB. Copyright: Christian Pichler

Our results will contribute to increasing the number of operative VRFB systems. This supports the installation of new PV and wind parks for renewable energy generation, as more opportunities for large scale energy storage will become available.

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This success story was provided by the consortium leader/centre management and by the mentioned project partners for the purpose of being published on the FFG website. Further information on COMET: www.ffg.at/comet