tubulAir+
Tubular Redox-flow Battery

C. Weidlich, P. Pyka, Lucas Holtz, J. Schuster, K.-M. Mangold
e-mail: weidlich@dechema.de
Funded by: BMBF
Period: 01.09.2012 - 31.08.2017

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

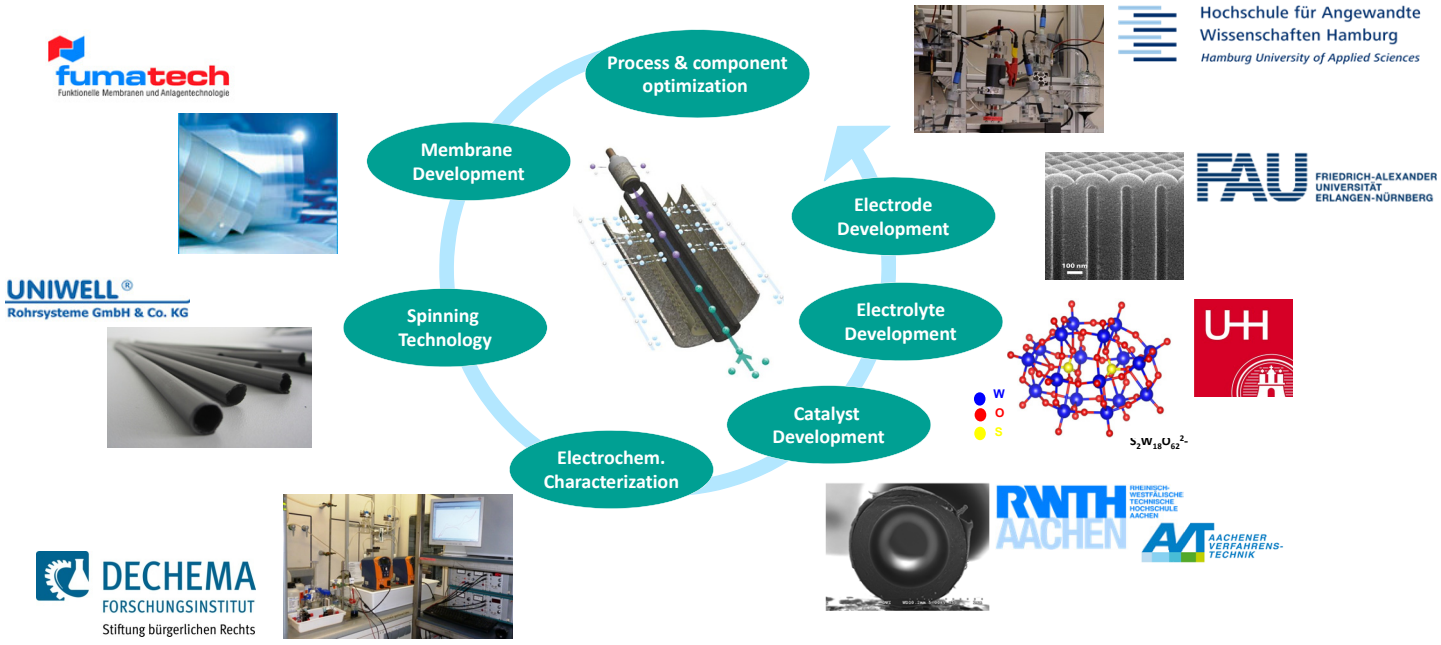
Tubular Vanadium Air Redox-flow battery

Main target of the joint project is the development of key technologies for the cost-effective manufacturing of a micro tubular Redox-flow battery with increased energy and power density for stationary appliances.

The planar All Vanadium Redox-flow battery (VRB) is suitable for this purpose. The comparatively low energy density (max. 37.5 Wh/kg) of the VRB as well as the cost intensive manufacturing of planar cell stacks require significant improvements for a broad market entrance.

To achieve higher energy density, the fluid electrolyte of the VRB on the cathode is replaced by an air/water steam electrode (GDE). For a better cost effectiveness, a micro tubular cell structure has been developed.
In this joint project a heterogeneous group of universities, institutes and companies provides a unique congregation of basic research to manufacturing experience.
The electrochemistry working group at the DFI functions as connective link between manufacturers of the single components and developers of the Redox-flow system.

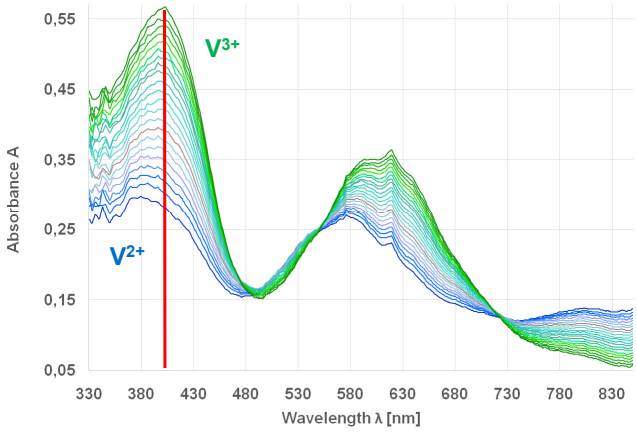
Partners and missions of the joint project



Online-Monitoring of charging and discharging processes

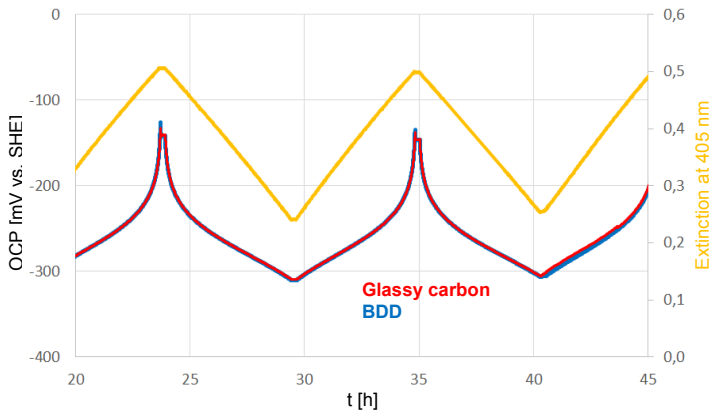
Redox reactions during charging and discharging

Positive half-cell:	$2H_2O \rightarrow 4H^+ + O_2 + 4e^-$	$4H^+ + O_2 + 4e^- \rightarrow 2H_2O$
Negative half-cell:	$4V^{3+} + 4e^- \rightarrow 4V^{2+}$	$4V^{2+} \rightarrow 4V^{3+} + 4e^-$



UV/VIS measurement via bypass through 0.1 mm flow-through-cuvette during charging the negative half cell (interval: 10 minutes)

At the DFI a simple method to ascertain the state of charge (SOC) of the electrolyte is developed: Open Circuit Potential (OCP) of the negative electrolyte is measured in single flow cells using a carbon rod or a Boron Doped Diamond (BDD) rod. SOC also can be identified by absorbance in the UV-Vis spectrum. To establish the SOC measurement UV-Vis spectroscopy and OCP measurements are compared.
A good correlation of absorbance at 405 nm and OCP of the electrolyte can be shown.



Extinction of the negative electrolyte at 405 nm and OCP of the negative electrolyte measured at a glassy carbon- or a BDD- rod during charging- and discharging