Development of a Tubular All Vanadium Redox Flow Battery

Stack Concept

The All Vanadium Redox Flow Battery

A redox flow battery is an electrochemical battery that consists of an electrochemical cell where the redox reaction takes place, two tanks for the storage of the electrolyte and pumps to transport the electrolytes through the electrochemical cell. Due to that structure it is, in contrary to the most other electrochemical batteries, possible to scale the power and the capacity independently from each other. The capacity depends on the tank volume and the power depends on the size of the cell. One of the most common redox flow batteries is the all vanadium redox flow battery.

For the assessment of the stack concept a simulation model was made in Matlab SIMULINK. The model includes an electrochemical and a hydraulic model to calculate the power and the energy efficiency of the stack. The model based analysis showed that a stack of tubular cells with the current cell properties would already have a power density that is in a range like existing stacks that are offered at the market. To increase the energy efficiency the tubular cells still have to be refined.

Development of a Stack Unit

Since the tubular all vanadium redox flow battery cell is already working well, there was the interest of a development of a stack unit. The stack unit combines several cells to provide a better handling. In the context of a masterthesis a concept of such a stack was developed. The concept includes solutions for the sealing, the electrical contacting, the electrical connection and the electrolyte supply of the cells. The stack is structured by smaller modules that can easily be assembled to have a good scaleability.

Model Based Analysis with Matlab Simulink

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