An Overview of Latest Research on Vanadium-Based Redox Flow Batteries at Fraunhofer ICT and UNSW

Jens Noack[1,2,3], Chris Menictas[2,3], Nataliya Roznyatovskaya[1,3], Maria Skyllas-Kazacos[2,3], Jens Tübke[1,3]

[1]Fraunhofer Institute for Chemical Technology, Germany; [2]University of New South Wales, Australia; [3]The German-Australian Alliance for Storage of Renewable Energy (CENELEST), University of New South Wales, Australia; jens.noack@ict.fraunhofer.de

Redox flow batteries (RFBs) are potential candidates for low-cost storage of renewable energy. Meanwhile, there is an almost unmanageable number of different types with a multitude of different active materials. Especially organic active materials have been increasingly investigated in the last 5 years. Nevertheless the Vanadium Redox Flow Battery (VRFB) is the best investigated and commercialized type of RFB and can make a decisive contribution to the solution of stationary storage needs. In this talk we give a short overview of some selected investigations that took place at Fraunhofer ICT and the University of New South Wales in the last years. These include investigations on vanadium redox flow batteries and especially further developments such as vanadium/oxygen cells (VOFC). For VRFBs and VOFCs e.g. electrode investigations were carried out to determine what causes the pre-treatment and whether the reactions can be accelerated. It was found that all reactions can be accelerated by several decades. In simulations different cell designs were investigated. Different new approaches such as toroidal cells were considered and compared with planar cells [1, 2].

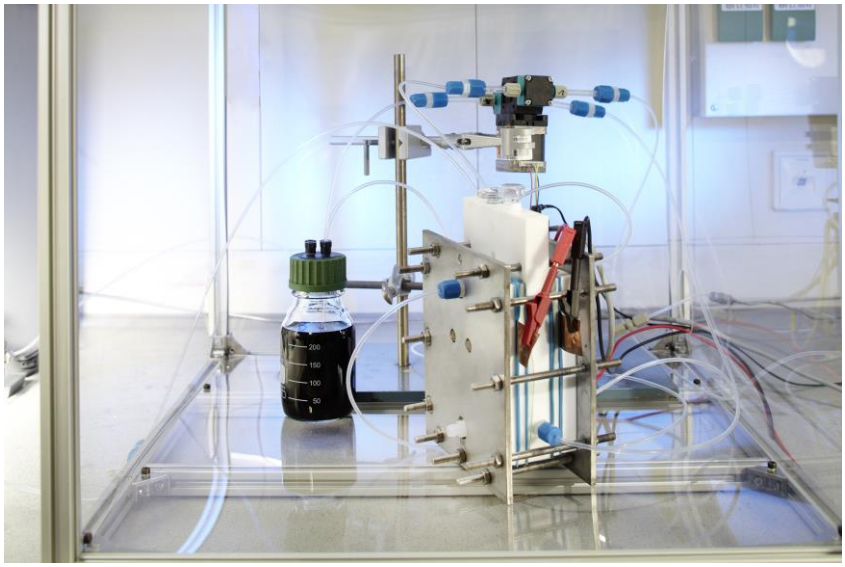

Figure 1: Vanadium/Oxygen cell based on two membranes

In order to increase the energy density of classical VRFB, investigations on vanadium-oxygen cells and electrolysers were performed. During long-term operation of a VOFC more than 700h with 1.6 M vanadium solutions were achieved [3]. To increase the energy density 3.5 M (max. theor. energy density ~150 Wh/L – 5 times higher than in VRFB) vanadium solutions were used and investigated in VOFCs [4]. The charging process was investigated in a separate electrolyser and energy efficiencies of up to 61% were achieved [5]. Furthermore, techno-economic studies of different redox flow battery systems with vanadium redox flow batteries were carried out. For example, a combination of VOFC and electrolyser was compared with a VRFB and the cost distribution was investigated.

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