

Automatic stacking of vanadium liquid flow batteries





Overview

Vanadium redox flow battery (VRFB) energy storage systems have the advantages of flexible location, ensured safety, long durability, independent power and capacity configuration, etc., which make them the promising contest. Vanadium redox flow battery (VRFB) energy storage systems have the advantages of flexible location, ensured safety, long durability, independent power and capacity configuration, etc., which make them the promising contestants for power systems applications. This report focuses on the design and development of large-scale VRFB for engineering-oriented applications. Begin with the analysis of factors affecting the VRFB for engineering-oriented applications, then the design method and process of large-scale VRFB are studied. After that, the optimal portfolio of the key materials and components are selected by orthogonal experiment. On that basis, a 25 kW VRFB stack consists of 60 single cells in series with an active electrode area of 3400 cm² is developed with an energy efficiency (EE) of over 78.

- 25 kW VRFB stack consists of 60 single cells is developed and evaluated.
- Use orthogonal experiments to determine the optimal combination of key components.
- A deep insight into design and evaluation of large-scale VRFB stack is provided.
- Working conditions induced performance of the large-scale stack are discussed.

Vanadium redox flow battery (VRFB)Engineering applicationsStructure designOrthogonal experiment.

Development of renewable energy is a significant channel to reduce global greenhouse gas emissions [1]. However, due to the volatility, intermittently and randomness of renewable energy, there is a certain degree of discrepancy between supply and demand of renewable energy power, which gives rise to its reliance on the regulation capacity of power system [2]. With the increasing pressure of renewable energy accommodation, the lack of system reserve capacity and the insufficient capacity of peak and frequency regulation and some other problems, the safe and stable of power grid confronts challenges. At this stage, the flexible regulation capability of power grid in peak hour mainly relies on the adjusting peak sets such as coal-fired power units and natural gas units. Due to the characteristics of power suppo.

2.1. Analysis of factors affecting EE of stackThe VRFB energy storage system consists of stacks, positive and negative electrolyte, pipeline system



(including circulating pumps, flowmeters, temperature sensors), energy conversion system, monitoring system, etc. The stack is the energy conversion device and the most important and complex part of a VRFB system. The stack is mainly composed of electrodes, ion exchange membrane, bipolar plates, liquid flow frames, liquid inlet plates, end plates, reinforcing plates and other components stacked by the fastening devices. The typical VRFB stack structure is shown in Fig. 1. A kW-scale stack typically evolves from a small VRFB single cell. To engineer an efficient kW-scale stack, one must understand the material, flow, and electr.

What is a vanadium flow battery?

Vanadium flow batteries are one of the preferred technologies for large-scale energy storage. At present, the initial investment of vanadium flow batteries is relatively high. Stack is the core component of a vanadium flow battery. The power density determines the cost of the stack.

What is a 70 kW vanadium flow battery stack?

Recently, a research team led by Prof. Xianfeng Li from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) developed a 70 kW-level high power density vanadium flow battery stack. Compared with the current 30kW-level stack, this stack has a volume power density of 130kW/m³, and the cost is reduced by 40%.

Are vanadium flow batteries a good choice for large-scale energy storage?

Compared with the current 30kW-level stack, this stack has a volume power density of 130kW/m³, and the cost is reduced by 40%. Vanadium flow batteries are one of the preferred technologies for large-scale energy storage. At present, the initial investment of vanadium flow batteries is relatively high.

What is a vanadium redox flow battery?

A vanadium redox flow battery consists of several basic elements: a flow cell (stack), which are fuel cells wherein an electrochemical reaction occurs; a hydrodynamic system, including pumps, flow sensors and a pressure pump control system; and electrolyte tanks [6]. Flow batteries require several stacks to achieve the desired performance [7].



Automatic stacking of vanadium liquid flow batteries

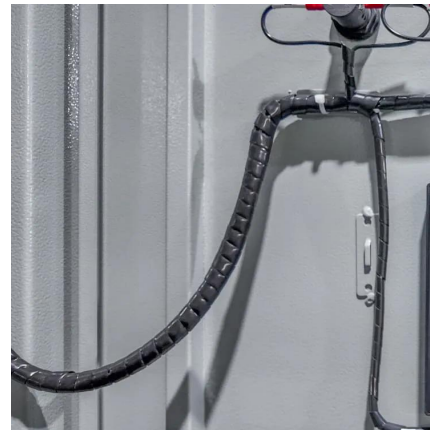


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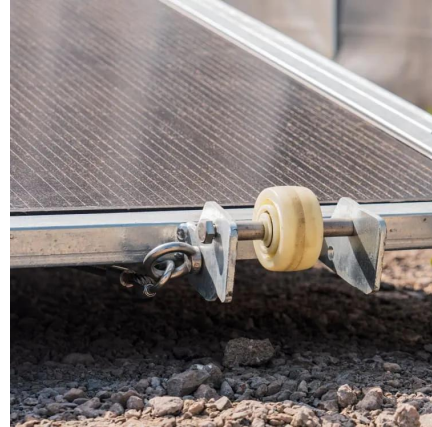
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