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MnVOH@SWCNT nanocomposites as cathodes for high-performance aqueous zinc-ion batteries

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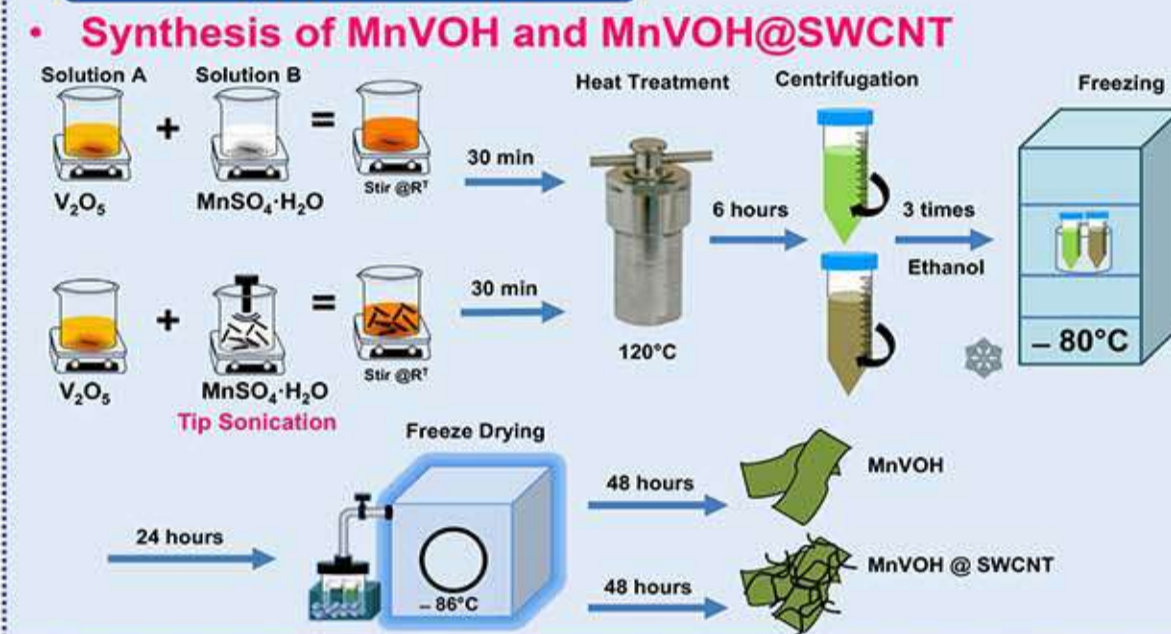


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Abstract

- Aqueous zinc-ion batteries (AZIBs) have gained prominence among various energy storage devices due to their high safety and low cost.
- MnVOH and MnVOH@SWCNT was synthesized using hydrothermal route and later followed by freeze-drying method.
- Operando synchrotron X-ray absorption near-edge spectroscopy (XANES) was studied to verify the Zn²⁺ charge-storage mechanism for the first time.

Experimental



Results

Electrochemical Performances

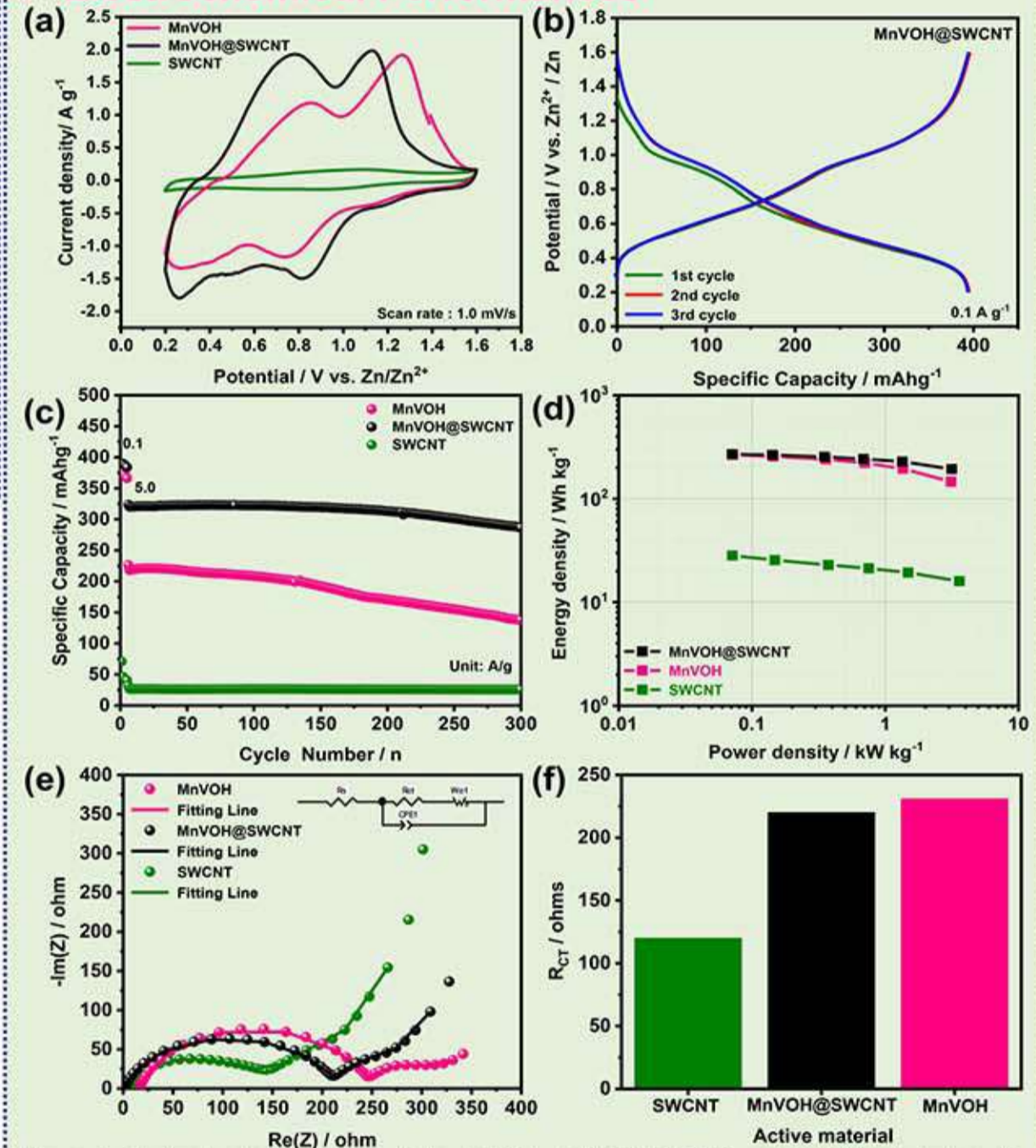


Figure 2: Electrochemical properties of the MnVOH, MnVOH@SWCNT, and SWCNT electrodes: (a) Cyclic voltammetry (CV); (b) Galvanostatic charge/discharge (GCD); (c) GCD for long cycle test; (d) Ragone plots; (e) Nyquist plots; and (f) Charge transfer resistance (R_{CT}).

Materials characterizations

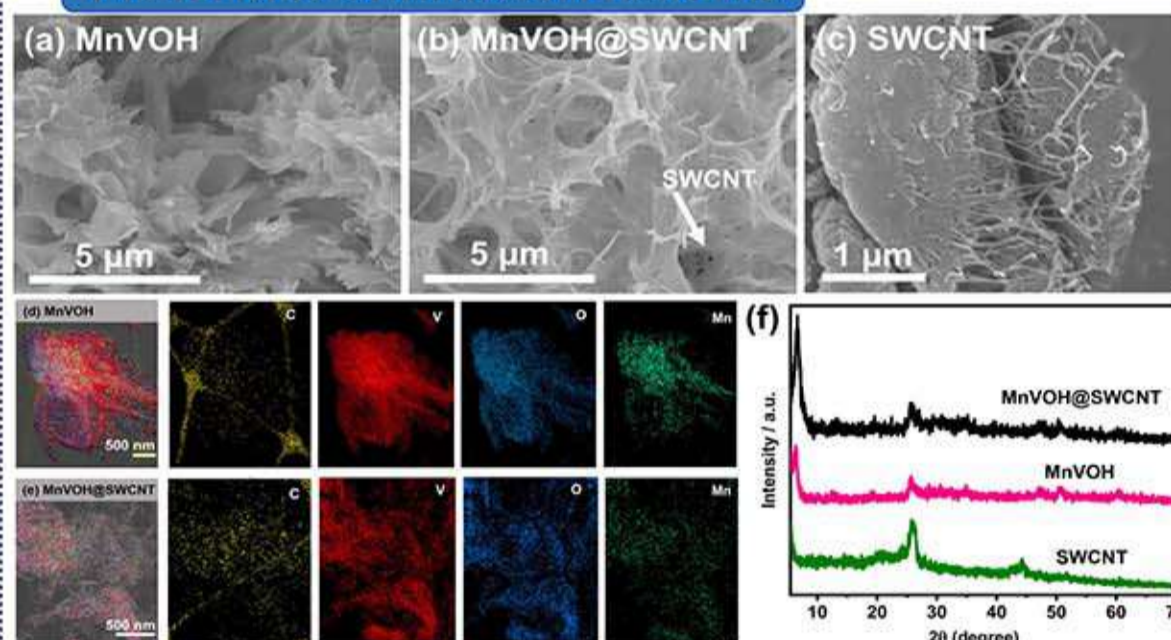


Figure 1: FE-SEM images of the various electrode materials: (a) MnVOH; (b) MnVOH@SWCNT; (c) SWCNT, TEM-EDX mapping images: (d) MnVOH; (e) MnVOH@SWCNT, and (f) XRD patterns of SWCNT, MnVOH, and MnVOH@SWCNT.

Journal Publications

- Sanna Gull, Shao-Chu Huang, Chung-Sheng Ni, Shih-Fu Liu, Wei-Shiang Lin, Han-Yi Chen*, "Operando synchrotron X-ray studies of MnVOH@SWCNT nanocomposites as cathodes for high-performance aqueous zinc-ion batteries", *Journal of Materials Chemistry A*, 2022, 10, 14540.
- Wei-Hsiang Lin, Shih-Fu Liu, Sanna Gull, Tzu-Chi Su, Kun-Ju Tsai, Chun-Han Kuo, Chia-Ching Lin, Chun-Chieh Wang, Ming-Hsien Lin*, Chia-Liang Sun*, Han-Yi Chen*, "Nanoporous core-shell-structured multi-wall carbon nanotube/graphene oxide nanoribbons as cathodes and protection layer for aqueous zinc-ion capacitors: mechanism study of zinc dendrite suppression by in-situ transmission X-ray microscopy", *Journal of Power Sources*, 2022, 541, 231627.
- Yen-Yu Tung, Sanna Gull, Chung-Sheng Ni, Wan-Ju Chiu, Han-Yi Chen*, "Recent Progress in Stretchable and Self-Healable Supercapacitors: Active Materials, Mechanism, and Device Construction", *Journal of Micromechanics and Microengineering*, 2022, 32, 073001.
- Shahnawaz, Sujith Sudheendran Swayamprabha, Mangep Ram Nagar, Rohit Ashok Kumar Yadav, Sanna Gull, Deepak Kumar Dubey, Jwo-Huei Jou*, "Hole transporting materials for organic light-emitting diodes: An Overview", *Journal of Materials Chemistry C*, 2019, 7, 7144-7158.
- Tsung-You Pan, Chen-Yen Wu, Sanna Gull, Ali Haider*, Han-Yi Chen*, "Improvement of Cycling Stability of Prussian Blue Analogues-based Aqueous Sodium Ion Batteries by Optimizing Electrolyte and Ligand Substitutions", *Electrochimica Acta*, 2022, 427, 140778.
- Sanna Gull, Han-Yi Chen*, "Recent Advances in Cathode Materials for Aqueous Zinc-ion Batteries: Mechanisms, Materials, Challenges and Opportunities", *MRS Energy & Sustainability*, 2022, 1-33, 2022.

Conclusions

- MnVOH@SWCNT provides high reversible capacity up to > 380 mAh g⁻¹ at a current density of 0.1 A g⁻¹ and capacity retention over 300 cycles.
- Operando synchrotron X-ray absorption near-edge spectroscopy (XANES) was used to study the charge-storage mechanism for the Zn²⁺ intercalation for the first time.

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