

Nickel Hexacyanoferrate electrodeposited on Ti as electrode for Mixing Entropy Batteries for energy extraction from water salinity gradient.

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Emission of greenhouse gases and limited amount of fossil fuels lead to the emerging need for renewable and sustainable energy sources. Sunlight, wind, geothermal, biomass, and oceans are well known renewable sources of energy, but less well known is salinity gradient. The Gibbs free energy released when river water flows into the sea has been identified as a source of renewable energy. Pressure retarded osmosis (PRO), reverse electrodialysis (RED), and capacitive mixing (CAPMIX) are the most investigated techniques to harvest salinity gradient energy¹. However, recently Mantia et. al. reported the use a new technique known as mixing entropy batteries (MEB); which consists of two electrodes: anionic electrode, which interacts specifically with Cl⁻ ions, and cationic electrode, which intercalate/deintercalate Na⁺ ions. Energy is produced with a four-step cycle. The battery is charged in fresh solution while the ions exit from their respective electrodes, exchanging the freshwater with saltwater leads the equilibrium potential to increase, then the battery is discharged with entering Na⁺ and Cl⁻ ions into cationic and anionic electrodes, at last exchanging the concentrated solution with diluted one results in the decrease of equilibrium cell potential. With this closed cycle energy is produced. In this context, the use of hexacyanoferrate as electrode for MEB with the aim to extract energy from water salinity gradients has been reported².

In this context, the Nickel Hexacyanoferrate electrodeposited on titanium by different method is evaluated, and applied as electrode for MEB, the results show that electrodeposition by step potential technique, where the vacancies are controlled, exhibit the better electrochemical properties during insertion/desertion process; increasing the energy storage capacity.

References:

[1] A. Achilli and A. E. Childress, *Desalination*, 2010, 261, 205.

[2] W. J. A.S. Gomes, C. de Oliveira, F. Huguenin, *Langmuir*, 2015, 31, 8710.