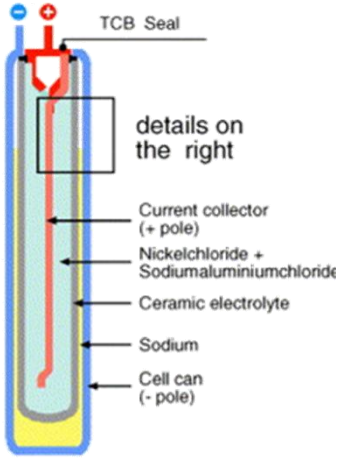
Kinetics and Open Circuit Potential Study on Porous Electrode in a Ni/Fe Half-Cell

Objective: Determining kinetic and micro-scale mass transfer parameters for use in a complete model of both the sodium-nickel chloride cell and the sodium-nickel/iron chloride cell.

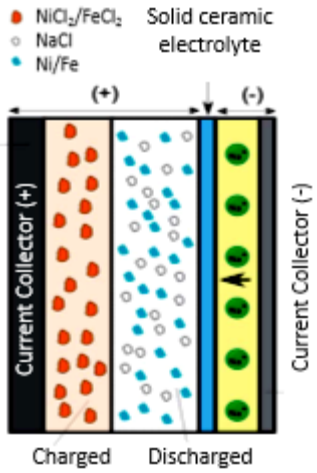
Description of Research: Using a small porous electrode in a Ni/Fe Half-Cell for model development and fundamental kinetics understanding. This experiment was chosen specifically to measure the overpotential and open circuit voltage of the positive electrode material.



Schematic representation of a Na/$NiCl_2$ (ZEBRA) cell. Source: Cord-H Dustmann, Journal of Power Sources, Volume 127, 1–2, 85-92,

Main Questions: What is the role of iron in this two-component system? How the different composition and temperature impact on the kinetics? What are the mechanisms to understand the kinetics and open circuit voltage behavior?

Major Challenge: There is mass transfer and conduction between the positive electrode materials. The positive electrode participate in ox/re neither homogeneously nor simultaneously.



Cell chemical reactions during discharging, Source: Institution of Electronic and Electrical Engineers

Benefits of Research Efforts:
A complete model of both the sodium-nickel chloride cell and the sodium-nickel/iron chloride cell is essential for optimizing the battery design and theoretical research.

The development of the model will help the development of this class of batteries with high energy density for renewable energy storage, uninterrupted power supply and hybrid transportation.

Potential Application for the molten salts battery system。Credit: Bloomberg BusinessWeek

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Collaborators and Funding:

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