Salty Seas to Sustainable Storage: Pioneering Sodium-ion Battery Development with AI and Cost Modeling

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1 Introduction

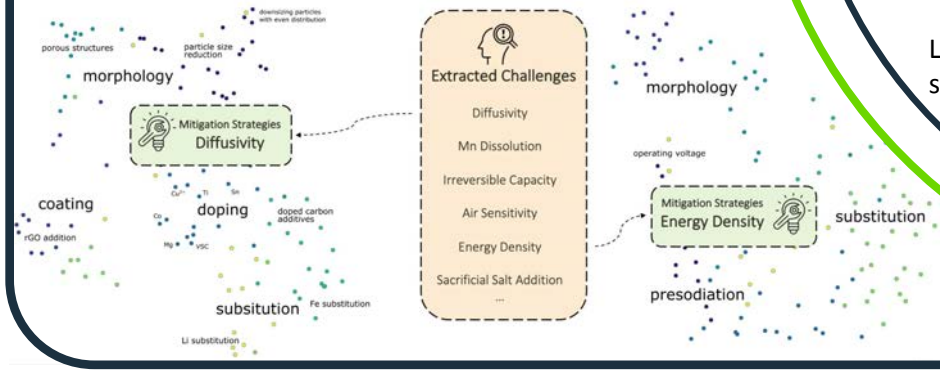
Sodium-ion batteries are intended to be a cost-effective alternative to lithium-ion batteries as Sodium is far more earth abundant as compared to Lithium. They also eliminate the use of Cobalt and can use Aluminum as current collectors instead of the more expensive Copper. However, several promising chemistries for Sodium-ion batteries are still limited to the lab scale. We plan to address the following questions:

What are the current challenges in the development of Sodium-ion batteries and how can they be mitigated?

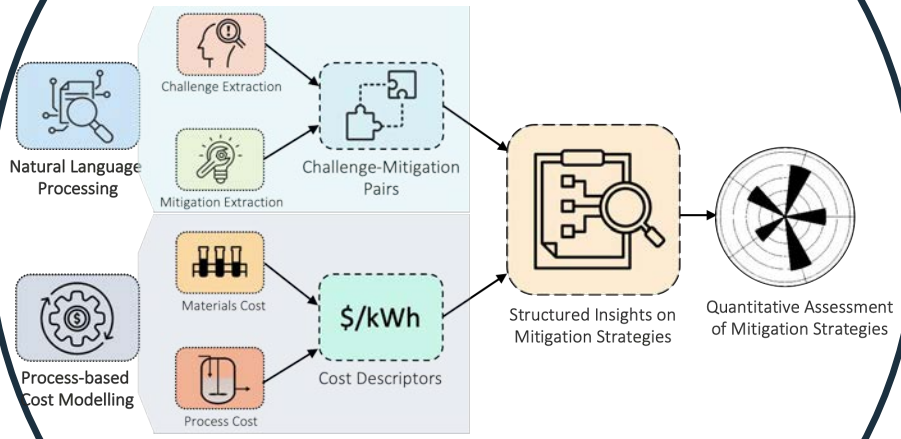
How do we select the best mitigation strategies among the numerous and often conflicting strategies such that they enable sodium-ion batteries to scale?

2

We can extract mitigation strategies from the literature and pair them with extracted challenges that hinder the scalability of Sodium-ion batteries



Using Natural Language Processing (NLP) and Cost Modelling Synergy to develop scalability informed hypothesis for sodium-ion battery development

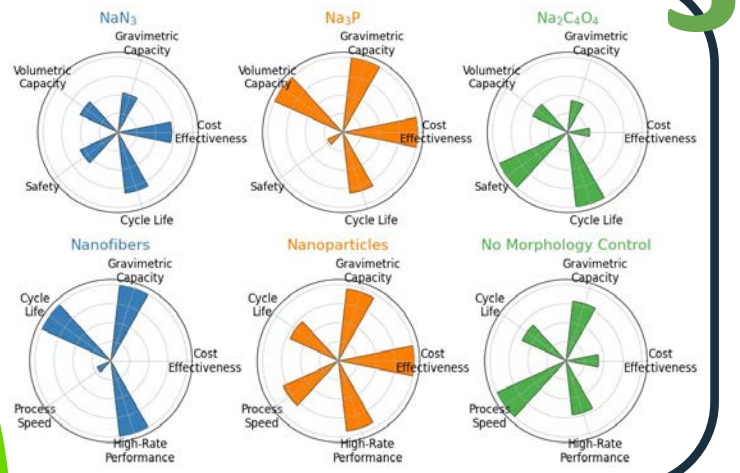


Leveraged the synergy of two methods to expedite the scalable development of Sodium-ion Batteries:

- Automated Article Extraction
- Process-based Cost Modelling

3

We can compare extracted strategies across cost and other metrics



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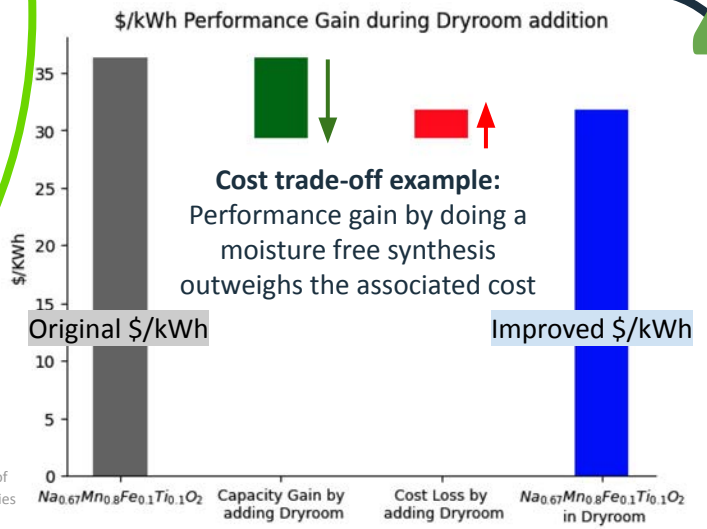

Cost trade-off example: Performance gain by doing a moisture free synthesis outweighs the associated cost

[1] Zhao et al. Engineering of sodium-ion batteries: Opportunities and challenges. Engineering 2021.

[2] Tapia-Ruiz et al., 2021 roadmap for sodium-ion batteries. Journal of Physics: Energy, 3(3):031503, 2021.

[3] Vaalma et al., A cost and resource analysis of sodium-ion batteries. Nature reviews materials, 3(4):1–11, 2018.