

## MITIGATION OF NASICON ANODES DEGRADATION IN AQUEOUS NA-ION BATTERIES

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Constantly growing production of renewable energy and e-vehicle industry creates high demand for new energy storage solutions with high power density, longevity, and reliability. Among all currently used and developed solutions electrochemical energy storage devices remain the most important. Indeed, Li-ion batteries is already well-developed technology, and is applied in multiple areas such as, portable electronic devices, e-vehicles, and stationary battery stations. However, due to limited resources of Li and other metals, ever growing demand for Li-ion batteries will very likely result in increased cost. Moreover, cobalt, organic electrolytes and other toxic substances used in this technology create environmental and safety issues. Therefore, development of new, greener alternative battery technologies is more important than ever. Batteries based on sodium, which is almost three hundred times more abundant than Li could be a viable candidate to complement existing Li-ion market by providing solutions where high-power density is not of primary importance. Indeed, owing to high ionic conductivity and structure rigidity NASICON-based (Na Super Ionic CONductor) aqueous sodium batteries could provide environmentally friendly solution as stationary batteries for grid energy storage. Although some NASICON materials show high stability in non-aqueous electrolytes, in aqueous media due to various parasitic reactions these materials tend to degrade much faster. In fact, NASICON-structured sodium titanium phosphate ( $\text{NaTi}_2(\text{PO}_4)_3$ ), which is considered as a promising anode material, in aqueous electrolyte suffers from low coulombic efficiency, self-discharge and fast capacity fade.

In this study, we attempted to identify degradation mechanisms of sodium titanium phosphate in aqueous electrolytes, by controlling and probing electrolyte pH, dissolved oxygen content, and electrolyte composition. In addition, we have assessed various strategies to mitigate its degradation by changing electrolyte composition, varying particle size and morphology, applying different carbon and ALD nano-coatings.