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Investigating lithium vanadium phosphate cathode materials for lithium- ion batteries

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Significant energy demand, especially on the African continent, has led to a need in the development of cost-effective energy storage devices with high performance. Lithium-ion batteries have been studied and used extensively due to lithium having one of the smallest ionic radii and the most negative reduction potential, being lightweight and being able to achieve a greater energy density and power density (Nitta et al., 2015). They are highly considered because of their potential to resolve the global warming challenge (Onoda et al., 2012). Phosphates have exhibited noteworthy operating potentials and high thermodynamic and kinetic stability. Vanadium has the advantage of tuning its oxidation state from V 2+ to V 5+ . Combination of these three components promises a cathode material that will possibly possess high lithium capacity, good ion mobility, a good capacity and a high operating voltage of approximately 4.0 V. Synthesis methods include a solid-state synthesis with a combination of grinding and annealing under a hydrogen gas atmosphere. Techniques useful for characterization of the cathode material include powder x-ray diffraction (PXRD), thermo-gravimetric analysis (TGA), transmission electron microscopy (TEM) and electrochemical testing that includes galvanostatic charge-discharge, cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS).

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