Evaluation of Properties and Performance of Nanoscopic Materials in Vanadium Diboride/Air Batteries

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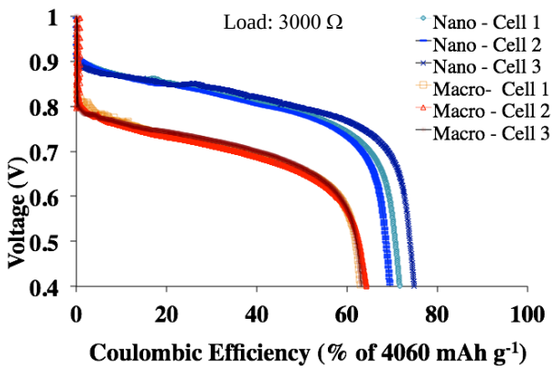
In recent years, there has been an escalating need for a high capacity battery that can meet the demands of emerging technologies. A nanoscopic vanadium diboride air battery is presented, utilizing an eleven electron per molecule oxidation with an intrinsic gravimetric capacity of 4060 Ah kg^{-1}, notably greater than that of the Li-ion or other comparable electrochemical energy sources.

In this study, cell performance is evaluated though the electrochemical characterization of the VB_2-air battery to develop a system that is capable of producing high capacities and voltages during rapid discharge rates.



The nanoscopic VB_2 material was characterized using transmission electron microscopy to determine particle size and morphology. Nitrogen physisorption experiments were performed to determine surface area and pore size. Electrical conductivity measurements were performed using a two-electrode powder conductivity configuration. Additionally, impedance testing was conducted before and after discharging of cells to evaluate reaction kinetics and internal resistance.

Nanoscopic synthesized VB_2 is shown to exhibit higher electrical conductivity hence lower resistance, lower impedance, and maximized surface area when compared to macroscopic commercial material. Furthermore, improvement in both the anodic capacities as well as the voltage plateaus at various discharge rates were observed.

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