RHEOLOGICAL DIFFERENCES IN ANODE SLURRIES CAUSED BY SHAPE DIFFERENCE BETWEEN NATURAL AND SYNTHETIC GRAPHITE

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ABSTRACT

Rechargeable lithium-ion batteries (LIBs) play an important role in today's industry because of their excellent charge capacity and high energy density[1]. The performance of LIBs is heavily dependent on the quality of the electrode, which must be well-constructed using active materials, binders, and additives. In particular, graphite is one of the most significant components serving as the active material in the anode electrode. Depending on the production method, graphite is classified as either natural or synthetic. It's application to small electronic devices or electric vehicles should take into account the unique advantages and disadvantages of each type. Natural graphite is known for its high capacity and affordability, making it a popular choice for small lithium batteries and general electronic products[2]. In contrast, synthetic graphite boasts excellent cycle performance and high charge/discharge efficiency, making it a preferred choice for batteries in automobiles and high-end electronic products[3]. To successfully manufacture the electrode, it is important to consider not only economic feasibility and electrical properties but also rheological properties. The rheological properties of the slurry are greatly influenced by the particle shape and composition of graphite, which can result in various slurry characteristics[4]. By analyzing the rheological behavior, it is possible to predict the microstructure of the slurry and develop solutions to prevent defects during the coating and drying process.

The aim of this study is to investigate changes in rheological properties based on the particle shape of graphite. To achieve this, slurries were prepared using natural graphite with a spherical shape and synthetic graphite with a flake shape, and different volume fractions of graphite were used while keeping the ratios of graphite, carbon black, and CMC fixed. Rheological tests such as oscillatory strain amplitude sweep tests were conducted to estimate the microstructure of the anode slurry. Additional experiments such as tap density measurement tests and sedimentation experiments were also conducted to support the results. The findings of this study will aid in controlling the rheological characteristics of battery slurry and designing optimal slurry constituents for the industry.

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