Rheological Properties of Battery Anode Slurry

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Understanding the rheological properties of lithium-ion battery slurries is crucial for optimizing electrode manufacturing processes. We present a comprehensive analysis of anode slurries, highlighting the significant influence of time and shear rate scales on their behavior. Our investigation reveals that these slurries exhibit a range of rheological phenomena, including yielding, thixo-viscoelastic, and shear-thinning or shear-thickening behaviors, depending on the applied stress and shear rate ranges. The Maxwell model, combined with thixotropic effects, provides valuable insights into both the short-term viscoelastic response and long-term thixotropic behavior of these materials [1]. While shear-thinning behavior was observed in the high shear rate ranges of model slurries with moderate solid content, it is noteworthy that highly concentrated graphite slurries exhibited shear-thickening behavior [2]. This shear-thickening phenomenon is closely related to anti-thixotropy and is attributed to the formation of a frictional contact network. Flow reversal tests indicate that this network partially persists even after flow cessation, possibly due to hydrophobic interactions. Our findings contribute to a deeper understanding of the intricate rheological behavior of battery slurries, encompassing yielding, thixotropy, viscoelasticity, and shear thinning or thickening. This comprehensive approach, emphasizing the roles of time and shear rate scales, allows for the extension of these insights to various types of battery slurries. The presented research lays a solid foundation for optimizing industrial electrode manufacturing processes and opens avenues for further detailed investigations in this critical field.

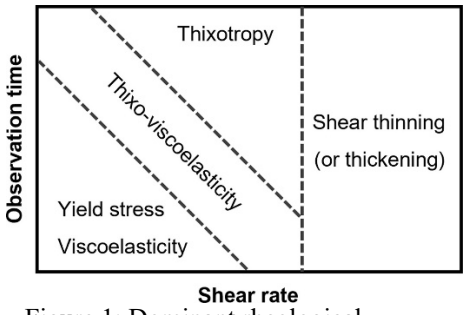

Figure 1: Dominant rheological properties of Li-ion battery anode slurry depending on time and shear rate scales.

References

[1] N. Park *et al., J. Power Sources*, **608** (2024).

[2] H. Jung *et al.,* Manuscript in preparation.

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