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Effect of Temperatures on Rheological Properties of Polyethylene Oxide (PEO)/Poly *n*-butyl Methacrylate (PnBMA) Blends

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Structured Abstract

Background: Solid polymer electrolytes (SPEs) have improved lithium-ion battery safety in recent years as compared to liquid electrolytes. A solid-state SPE lowers leakage, flammability, and other safety issues, making them desirable for applications with tight safety requirements. Blending of two or more polymers is chosen as the polymer electrolytes to improve the conductivity of the systems. By understanding the flow behaviour and mechanical relaxation of miscible or immiscible polymer blends is necessary to explain their physical properties such as rheology in SPE materials.

Methods: The solution casting method is used to prepare the blends of polyethylene oxide (PEO) (M_w = 3.00 × 10^5 g mol^{-1}) and poly *n*-butyl methacrylate (PnBMA) (M_w = 3.37 × 10^5 g mol^{-1}). This study aims to address the knowledge gap and improve the practical utility of PEO/PnBMA blends by examining their modulus, viscosity and temperature dependencies. Rheometer (Anton Paar, Model: MCR 302) was used to investigate the rheological characteristics with blend compositions varied from 100/0 to 0/100 (*m*/*m*) at different temperatures (80 °C to 140 °C with 20 °C intervals) with a frequency range of 100 - 0.01 Hz.

Results: The research reveals significant insights into the rheological properties of PEO/PnBMA blends. The modulus and viscosity across diverse blend compositions were investigated, providing insights into the behaviour of the materials. Moreover, variations in temperature within the range of 80 °C to 140 °C demonstrate significant impacts on the rheological properties. As temperatures rise, PEO at higher compositions shows that *G"* is higher than *G'*, indicating liquid-like behaviour and less viscousness.

Conclusion: In conclusion, the effects of blend compositions and temperatures on modulus and viscosity contribute valuable insights into the long-term durability and stability of the blends. These findings offer a foundation for optimizing the application of PEO and PnBMA blends in practical settings, fostering advancements in polymer blend technology.

Keywords: Polyethylene oxide, Poly *n*-butyl methacrylate, Polymer blends, Rheological properties

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