Gel polymer electrolytes from renewable sources for Lithium-Oxygen batteries applications.

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The increasing demand for clean energy production, driven by global warming, has directed research towards developing cleaner and more efficient energy storage solutions and electric vehicle technologies. Among the most promising technologies under investigation is the lithium-oxygen battery, which boasts a high theoretical energy density of approximately 11,000 Wh kg^{-1}. This remarkable value is attributed to the use of a metallic lithium anode and, notably, porous carbon cathodes such as gas diffusion layers (GDL) through which oxygen, the active material, flows from the outside. However, the use of metallic lithium anodes presents several challenges that affect the stability and cycling of these batteries. To address these issues, this study examines biorenewable organogel polymer electrolytes for lithium protection.

The biorenewable organogel polymer electrolytes are derived from gelatin obtained from cold water fish skin. After a single-step methacrylation in water, the methacrylated gelatin is directly cross-linked in the presence of a liquid electrolyte through UV-initiated radical polymerization. The resulting gel polymer electrolytes exhibit good thermal and mechanical properties, excellent electrochemical stability against lithium metal, and ionic conductivities as high as 2.51 mS cm^{-1} at room temperature. Li-O_2 cells assembled with these biorenewable gel polymer electrolytes are able to perform more than 100 cycles at 0.1 mA cm^{-2}, under constant O_2 flow, at room temperature, and at a fixed capacity of 0.2 mAh cm^{-2}. Post-mortem analysis of the cathodes confirmed that the cross-linked gelatin matrix was able to slow down solvent degradation, thereby enhancing cell reversibility.

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