Semi-IPN Composite Gel Polymer Electrolyte with Vinyl-Functionalized Silica for Lithium-Oxygen Batteries with Good Cycling Stability

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Developing a stable electrolyte not only to suppress solvent evaporation and dendritic lithium growth, but also to endure the attack by superoxide anion radical formed during electrochemical reactions is an important challenge for long-term Li-O_2 batteries.[1-3] In this study, the semi-interpenetrating polymer network (semi-IPN) composite gel electrolyte was synthesized from poly(methyl methacrylate), divinylbenzene, and vinyl-functionalized silica. It effectively encapsulated electrolyte solution and exhibited stable interfacial characteristics toward lithium electrode. Matrix polymers in the semi-IPN composite gel electrolyte also retained high stability without any decomposition by superoxide anion radicals during cycling. Our results demonstrate that the cycling performance of a lithium-oxygen cell composed of a lithium negative electrode and porous carbon positive electrode (without a catalyst) was remarkably improved with good capacity retention as compared to liquid electrolyte-based Li-O_2 batteries.

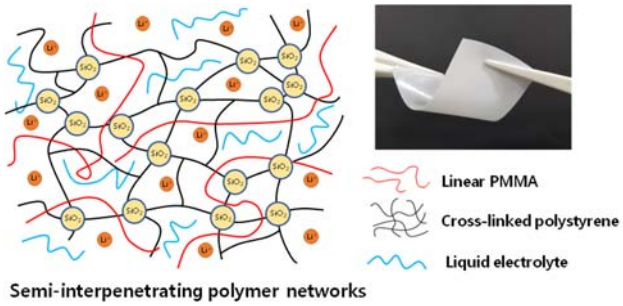

Figure 1. Schematic illustration of the three-dimensional semi-IPN composite gel electrolyte.

References:

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[3] C. V. Amanchukwu, J. R. Harding, Y. Shao-Horn, P. T. Hammond, Chem. Mater. 27 (2015) 550–561.