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Polymers for new battery technologies.

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The chemical and electrochemical reactivity of the components comprising today's lithium batteries has severely limited their lifetime and stability, and attempts to push the limits on energy density have exacerbated these stability issues. The weakest link in terms of safety and stability of Li ion systems is the organic liquid electrolyte that facilitates the Li^+ ion transport between the electrodes. The electrolyte is flammable and electrochemically unstable against the graphitic anode. It is the continuous electrochemical degradation of the electrolyte at the electrodes that leads to poor cycle life of the batteries, and in some cases runaway reactions that lead to explosions. Dry polymer electrolytes alleviate the electrochemical stability problem by offering a stable electrode-electrolyte interface. The absence of flammable liquids prevents runaway reactions. The main hurdle that has prevented dry polymer electrolytes from being commercialized is low ionic conductivity, and challenges in interfacing with the electrode materials. We demonstrate a novel approach towards addressing these challenges that renders batteries with excellent cycle lives, and thermal stability.