Lithium-air batteries: A brief review

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Lithium-ion batteries facilitated an impressive variety of consumer electronics in the last couple decades through provision of higher energy storage capability compared to conventional systems. Energy storage in automobiles requires much higher specific capacity than the state-of-art lithium ion battery can deliver. Improving the capacity drastically by replacement of cathode with air was proposed recently. Trials to replace conventional cathode in lithium-ion battery with porous carbon led to variety of inter-related problems such as, poor reversibility of reactions, considerable voltage loss across cathode, clogging of cathodes with insoluble products, high sensitivity of the system to moisture, decomposition of electrolyte by products and dendrite formation on metallic anode. Poor reversibility of reactions and voltage drop across cathode can be effectively minimized through suitable catalysts. Efficiency up to 75% with employment of Pt/Au bifunctional nanocatalyst was reported. Clogging of cathode by insoluble products and electrolyte decomposition was effectively addressed through aqueous electrolytes with a significant compromise in theoretical capacity. Reactivity of lithium and dendrite formation are mitigated through artificial SEI films. Aqueous systems deliver higher practical capacity than aprotic systems, even though its theoretical capacity is an order less than that of aprotic systems.

Even with a number of ingenious solutions to the surge of problems observed, there is still a long way to go for the practical application of lithium-air batteries. The catalysts, that deliver promising performance, are too expensive to be employed in any commercial energy storage solution facility. The working mechanism of catalysts is still need to be understood. Significant amount of work has to be done on separating oxygen from unacceptable contaminants such as carbon dioxide, since most of the researchers used pure oxygen. The motive behind the works done on lithium-air systems, techniques utilized to tackle the issues, significant issues that are still need to addressed and the position of lithium-air battery as energy storage solution for future will be presented and discussed.