The Effect of Perfluorocarbon Additives on Li-air Battery Performance

Moran Balaish, Alex Kraytsberg and Yair Ein-Eli
Department of Materials Science and Engineering, Technion, Israel Institute of Technology, Technion, Haifa 32000, Israel
mbalaish@tx.technion.ac.il

The worldwide interest in high energy density batteries has increased due to the development of electrical vehicles. The current state-of-art batteries can hardly provide sufficient energy to meet the challenges of the next generation technologies, including transportation. Lithium–air battery chemistry offers the highest energy density among other chemistries. However, several obstacles need to be overcome before the Li–air battery can be considered feasible. One of the challenges is low oxygen availability at the cathode of the cell. The ability of aprotic polar solvents to transport oxygen is a crucial parameter, which determines the energy and power capacities of the cell[1]. Specifically, the organic electrolyte precludes the occurrence of three-phase gas/electrolyte/catalyst interface and since oxygen solubility is low in most of organic electrolytes, and non-availability of the reagent (oxygen) makes it impossible to use all cathode surface and volume. This circumstance substantially reduces the Li-air cell discharge and current performance. PFCs (Perfluorocarbons), added directly to the non-aqueous electrolyte, has been shown to enhance the O_2 solubility in the electrolyte and significantly improving the rate capability of the air electrode for Li–air batteries [2]. Based on the "two phase reaction zone" model [3], we hereby introduce a new approach for providing high oxygen solubility and diffusivity in the Li-air system using PFC. We successfully demonstrate that air cathode impregnated with oxygen carriers compounds, PFC, substantially increases the cathode discharge capacity and improves the Li-air overvoltage. Cathodes with PFC have higher performance and in some cases PFC's enhanced the capacity by 200%.

References

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