Secondary aprotic Li-O_2 batteries: challenges and perspectives

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The reversible redox activity of triplet oxygen molecules in aprotic electrolytes is the fundamental working mechanism of Li-O2 secondary batteries. This battery chemistry belongs to the so-called generation-5 electrochemical energy storage devices and are expected at EU level to deliver technological applications to the market in 2035-2040. Many open challenges need to be addressed mainly dealing with the O2→Li2O2→O2 reversible transformation at the positive electrode, the Li0→Li+ plating/stripping process at the negative electrode and all the parasitic chemistry involving the electrolyte. Thus, the need to develop innovative experimental and theoretical methods to disclose insights at molecular/atomic level resolved both in time and space. Here we discuss the expected impact of the Li-O2 battery technology and the most relevant fundamental phenomena that hinder applications.