RECHARGEABLE LITHIUM METAL POLYMER (LMP) ORGANIC BATTERIES USING A COMMERCIAL POLYMER ELECTROLYTE

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Bolloré group, through its branch BlueSolutions, invests in many electricity storage projects for diverse outlets. Most famous ones find applications in mobile solutions such as the well-known Bluecar® or electrified buses, visible for example in cities like Paris (Autolib), Bordeaux or Lyon and more recently Indianapolis. However, stationary applications are of prime importance, notably for the African market. Thus Bolloré group currently invests in countries such like Togo or Niger by developing railway lines that will be bordered by Bluezones. The latter consist in little cities (with school, free clinic center …) with autonomous energy supply thanks to the combination of solar PV with Lithium Metal Polymer (LMP) batteries. In this context, it urges to find innovative solutions to promote the stationary storage market. Whereas automotive applications require high volumetric energy densities, it is well known that low cost systems are required for stationary storage. Within this background, some organic electroactive compounds could be of significant interest due to their specific capacities, resource sustainability, environmental friendliness, structure diversity, and so on [1].

The presented work will focus on two different electroactive prototype compounds: tetramethoxy-*p*-benzoquinone (TMQ) as a representative of small (neutral) molecules and Indigo carmine as representative of redox-active organic salts. We have assessed these organic materials in place of $LiFePO_4$ in the composition of commercial LMP batteries by notably using a commercial dry polymer electrolyte. Interestingly, the as-obtained electrochemical behaviors depart from those already observed in regular carbonate-based liquid electrolytes. In particular, reversible two-plateau cycling curves were observed for indigo carmine that must be compared to a unique and sloping plateau measured in conventional liquid electrolytes as described by M. Yao and co-workers [2].

Moreover, very promising results were obtained with TMQ [3]. Basically, when carbonate-based electrolytes are used, this quinone exhibits quite poor electrochemical features such as a very limited depth of discharge (~50% of the theoretical capacity in the first cycle). Under LMP classical cycling conditions (100°C as operating temperature), TMQ reacts according to its theoretical two-electron process. With no optimization, the restored capacity represents 80% of the theoretical value (190 mAh/g) after 20 cycles operated at a C rate.

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