

## New Organic Mixed Ionic and Electronic Polymer Binder Materials for Lithium-Ion Battery Electrodes

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Lithium-ion batteries (LIBs) have become indispensable energy-storage devices for various applications, ranging from portable electronics to electric vehicles and renewable energy systems. The performance and reliability of LIBs depend on several key components, including the electrodes, separators, binders and electrolytes. Among these, the choice of binder materials for the electrodes plays a key role in determining the overall performance and durability of LIBs. To overcome this limitation and progress towards the development of solid-state batteries, conductive oligo/polymers are recently proposed.<sup>[1,2]</sup> In this work, new Organic Mixed Ionic/Electronic Conductors (OMIECs) has been studied as new LIBs functional binder solid polymer electrolyte (BSPE). The suitability of two prototypal OMIECs was thoroughly studied: poly(3,4-ethylenedioxythiophene)-b-poly(ethylene glycol) (P2) and poly(3,4-ethylenedioxythiophene), bis-poly(ethyleneglycol), lauryl terminated (P3), shown respectively in the Figure 1.a and 1.b. P2 and P3 were found to be thermally stable up to 150°C and 220°C, respectively by TGA analysis. The oxidation (p-doping) of these OMIECS is electrochemically reversible and stable from extended cycling when using LiPF<sub>6</sub> and LiTFSi as a supporting electrolyte. A second generation of OMIECs, specifically the 2,7-bisthiophenecarbazole featuring an electroactive TEMPO radical (pBTC-TEMPO) which is represented in the Figure 1.c has been successfully polymerized. This redox and electroactive polymer demonstrates stable galvanic cycling behaviour and maintains high electrochemical performance at high C rates, despite its moderate specific capacity. Additionally, the carbon content can be significantly reduced and the polymer pBTC-TEMPO shows a capacity loss of only 20 % between 10 C and C and 40 % between 20 C and C, which is a noteworthy experimental result.<sup>[3]</sup>

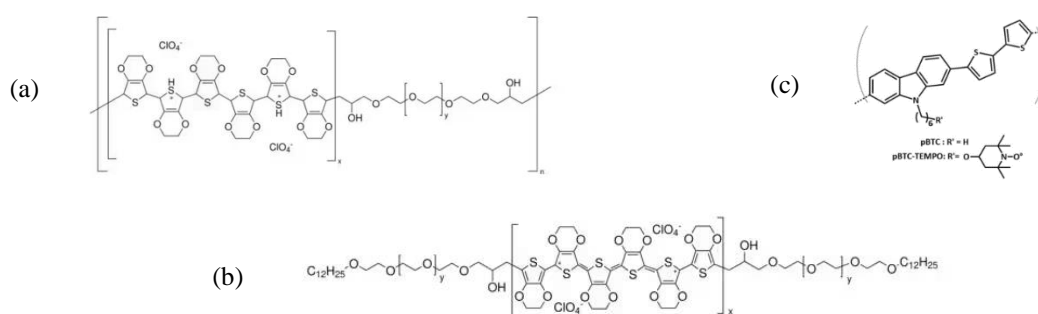


Figure 1: Chemical structures of OMIECs (a) P2, (b) P3 and (c) pBTC-TEMPO

This work was supported by the European Projects SOLiD (HORIZON-CL5-2021-D2-01-05)

### References

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