Capacity-enhancing polymer coatings for Li-S battery cathodes

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The rechargeable lithium-sulfur (Li-S) battery has been the subject of revived interest in recent years by virtue of its high theoretical energy density and low cost. However, the retention of capacity in this system suffers from significant drawbacks, for example the dissolution of active material into the electrolyte on discharge and the redox shuttle mechanism of dissolved intermediate polysulfides[1].

One strategy which aims to address these drawbacks is the coating of polymers such as poly(ethylene glycol) (PEG) onto the cathode surface, such as has been demonstrated either by functionalisation of the surface[2] or coating by other conventional methods[3]. Such polymer coatings are thought to improve performance by retaining active mass at the cathode and preventing it from diffusing away into the electrolyte.

In this work, we aim to investigate whether suppression of cathode passivation is a significant effect of these polymer coatings on the capacity enhancement, using electrochemical techniques such as galvanostatic cycling, cyclic voltammetry and impedance spectroscopy. New investigations of the effect of a self-assembled, thin, conformal polymer coating based on highly cross-linked PEG will also be presented.

References:

[1] S.S. Zhang, J. Power Sources 231 (2013) 153.

[2] X. Ji, K.T. Lee, L.F. Nazar, Nat. Mater. 8 (2009) 500.

[3] J.-Q. Huang, Q. Zhang, S.-M. Zhang, X.-F. Liu, W. Zhu, W.-Z. Qian, F. Wei, Carbon (2013) 1.

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