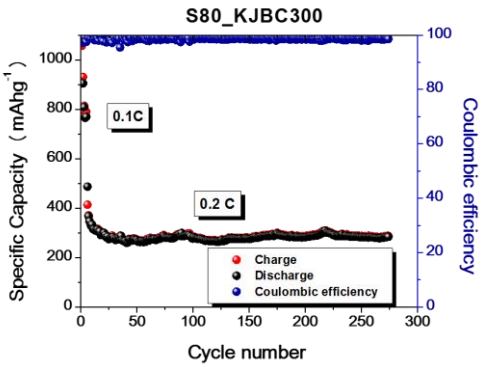
Materials Poster Abstract

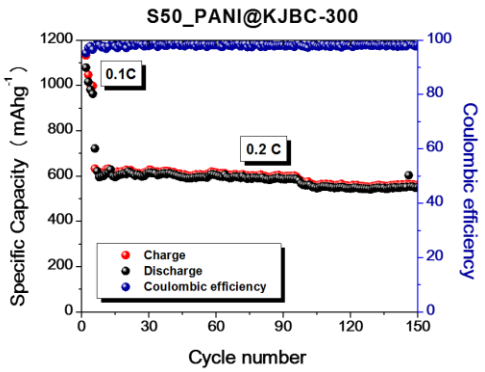
PANi wrapped Ketjen Black Carbon/Sulphur composites for Li-S batteries

Usman Zubair[1], Julia Amici[1], Daniele Versaci[1], Carlotta Francia[1], Silvia Bodoardo[1], Nerino Penazzi[1]
[1] Politecnico di Torino, Department of Applied Science and Technology (DISAT),
C.so Duca degli Abruzzi 24 - 10129 Torino – (ITALY) email: silvia.bodoardo@polito.it

Li/S batteries have attracted much attention in recent years due to their high theoretical capacity of 1672 $mAhg^{-1}$ and low cost. The practical energy density of packaged Li-S batteries could be roughly 400 – 600 $Whkg^{-1}$ and could satisfy a traveling distance of 500 km for electric vehicles. Many challenges such as low sulphur conductivity, shuttling of polysulphides, poor rate capability and low Coulombic efficiency are still to overcome. In some cases, cost and complex preparation processes of nanostructured materials can hinder the wide spread of Li-S batteries in the market. Here, we report the synthesis of a polyaniline wrapped carbon/sulfur composite through a cost effective and facile synthetic procedure. Commercial Ketjen Black Carbon (KJBC) particles are the core structure of the composite positive electrode material in which sulphur is confined by melt infusion. Conductive polyaniline (PANi) was synthesized by a chemical method through in situ low temperature oxidative polymerization of aniline on KJBC/S composite particles using formic acid as dopant. PANi synthesized in formic acid medium [1] demonstrated higher electrical conductivity than PANi synthesized in of hydrochloric acid medium [2] as well as greater doping degree. Compared with its KJBC/S composite counterpart, the PANi wrapped KJBCB/Sulphur composite demonstrated improved cycleability, owing to the presence of internal void space inside the polymer shell to accommodate the volume expansion of sulphur during lithiation. The PANi wrapped KJBC/Sulphur composite exhibited a stable capacity of 600 mAh g^{-1} at 0.2 C after 300 cycles, representing a promising future electrode for industrial scale Li–S batteries.



Capacity vs. cycle number of Li/S cell with KJBC/S composite cathode in DME:DIOX 1:1 (v/v) 1M LiTFSI 0.25M $LiNO_3$. Sulphur loading 80%



Capacity vs. cycle number of Li/S cell with PANi wrapped KJBC/S composite cathode in DME:DIOX 1:1 (v/v) 1M LiTFSI 0.25M $LiNO_3$. Sulphur loading 55%, PANi loading: 35 %..

Acknowledgements
Financial support was provided by the European Union H2020 NMP-17-2014 ALISE (GA 666157).

References

[1] E. C. Gomes, M. A. S. Oliveira, American Journal of Polymer Science, 2(2) (2012) 5-13.
[2] J. Wang, K. Yue, X. Zhu, K. L. Wang, L. Duan, Phys. Chem. Chem. Phys., 18 (2016) 261-266.