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Fast Charge and High Stability of Solid-State Graphite Organic Ionic Plastic Crystal Composite Anodes


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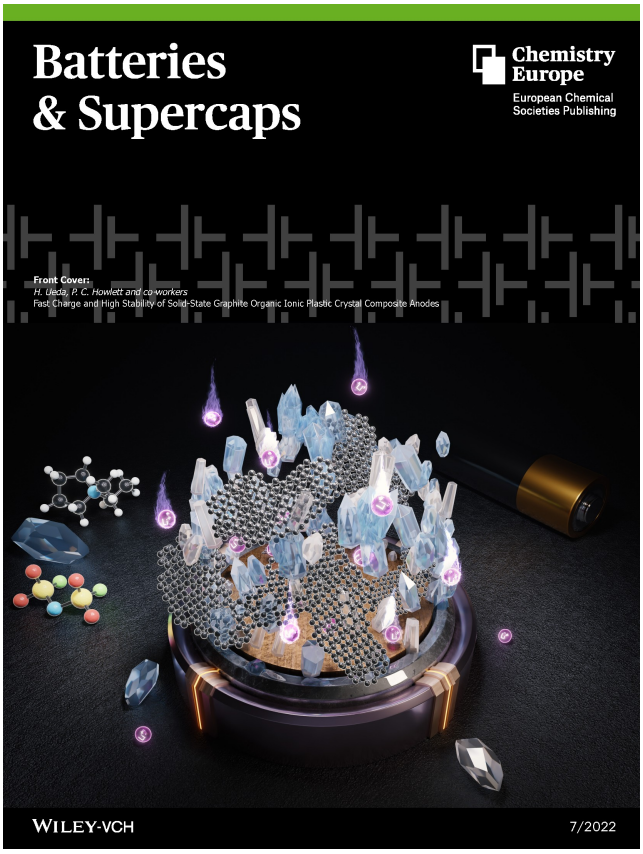
Invited for this month's cover picture is the group of Dr. Hiroyuki Ueda and Prof. Patrick C. Howlett at Deakin University (Australia) jointly working with Toyota Motor Corporation (Japan). The cover picture shows the fast lithium-ion conduction pathways in the graphite anode of all-solid-state batteries (ASSBs) enabled by the incorporation of an organic ionic plastic crystal (OIPC) electrolyte. Read the full text of the Research Article at 10.1002/batt.202200057.

What prompted you to investigate this topic/problem?

Safe, reliable, and high-performance energy-storage technologies are demanded to realize a sustainable society. In this respect, the replacement of liquid electrolytes (LEs) in secondary batteries with solid electrolytes (SEs) will be a breakthrough, and many highly ion-conductive inorganic SEs have been discovered. However, their incorporation into ASSBs is a major challenge; Their interfacial formation is complicated and often costly. This keeps requiring the exploration of soft SEs, e.g., organic ionic plastic crystal (OIPCs). Although OIPCs showed great promise for ASSB applications as firstly reported in 1999 (DOI: 10.1038/45514, https://www.nature.com/articles/45514), their use in electrodes had been disregarded, which prompted us to study this topic.

What is the most significant result of this study?

We demonstrated the high charge rate capability of the graphite-OIPC composite anode, which was at the same level as that of the graphite anode in a LE, and the stable cyclability of the anode with a proper amount of the OIPC SE.



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What future opportunities do you see (in the light of the results presented in this paper)?

Our findings have opened an avenue for fabricating groundbreaking OIPC-containing ASSBs with various cell chemistries. Especially, studies on such ASSBs using high-capacity active materials (e.g., S and Si) will be important topics.

Who designed the cover?

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