Batteries & Supercaps

Cover Profile
doi.org/10.1002/batt.202400166

Chemistry Europe
European Chemical Societies Publishing

www.batteries-supercaps.org

Elucidating Gas Evolution of Prussian White Cathodes for Sodium-ion Battery Application: The Effect of Electrolyte and Moisture


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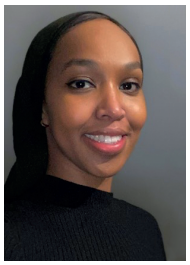
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Invited for this month's cover picture is the group of Torsten Brezesinski at KIT. The cover picture shows gases evolving from a Prussian white cathode used in Na-ion batteries in the presence of either $NaPF_6$- or $NaClO_4$-containing electrolyte. H_2 and CO_2 are detected, as well as $(CN)_2$, for which a formation mechanism is proposed. Read the full text of the Research Article at 10.1002/batt.202300595.

What prompted you to investigate this topic/problem?

At BELLA, we had previously observed the evolution of $(CN)_2$ from Prussian white (PW) electrodes. For a study to identify the root cause and mechanism and rule out impurities, however, we needed larger quantities of Fe-only cathode material and electrodes of higher loading and quality.

At WMG, as a part of the EU-funded SIMBA project, we had previously studied the dehydration effect on the structural, morphological and electrochemical properties of aqueous processed PW electrodes. The results obtained triggered interest in further understanding gassing of PW cathodes under regular and overcharge conditions.

How did the collaboration on this project start?

Ivana and Sören met at the International Battery Association (IBA) conference in 2022 and realized that they each had what the other was interested in.

What aspects of this project do you find most exciting?

There is something in here for everyone, from the application-relevant role of water content control over DEMS instrumental considerations in detection and comparison of $(CN)_2$ and HCN to the proposed reaction mechanism that explains the observations in light of the available literature. The electrolyte effect on gas evolution and our findings encourage further research in this direction, highlighting the importance of a deeper understanding of structure-property correlation of industrially relevant battery materials.

What new scientific questions/problems does this work raise?

For PW and related battery materials, the electrolyte-dependent formation and composition of the cathode electrolyte interphase (CEI), including polycyanogen, seem worth a closer look. For the evolution of $(CN)_2$, quantification is still needed, and under closed headspace conditions, follow-up reactions might occur.