SUPPORTING CRITICAL RAW MATERIAL CIRCULARITY – GRAPHITE FROM WASTE LIBS TO ZN-AIR BATTERIES

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Lithium-ion batteries (LIBs) have continuously growing use in consumer electronics and electrical vehicles, which also increases the amount of spent LIB (SLIB) waste in the foreseeable future. LIBs contain many valuable materials, however only Co and Ni from cathode are currently recovered during the industrial black mass recycling process. On the other hand, graphite, the anode active material of LIBs, is discarded as a waste during the same industrial process. Revalorizing graphite from this waste has a huge potential as a low-cost alternative to pristine graphite.

In this research a novel way to prepare bifunctional oxygen electrocatalyst from industrially produced and hydrometallurgically leached black mass leach residue is shown. The recycling leach residue is utilized as a valuable raw material, graphite and transition metal (Co, Mn, Ni) source, with N-precursor for the synthesis of N-Me-C graphite-based electrocatalyst. For the first time the battery metal residues, left into SLIBs recycling waste, are strategically exploited to achieve metal co-doping of graphite-based material. These synthesized materials showed promising electrocatalytic activity in alkaline media towards ORR and OER. Power density of 104 mW·cm^{-2} (Figure 1) was achieved with this novel bifunctional oxygen electrocatalyst.

This research shows the great potential of SLIBs black mass leach residue as a resource for the more sustainable production of high performance and low-cost bifunctional oxygen electrocatalyst appliable in Zn-air battery.

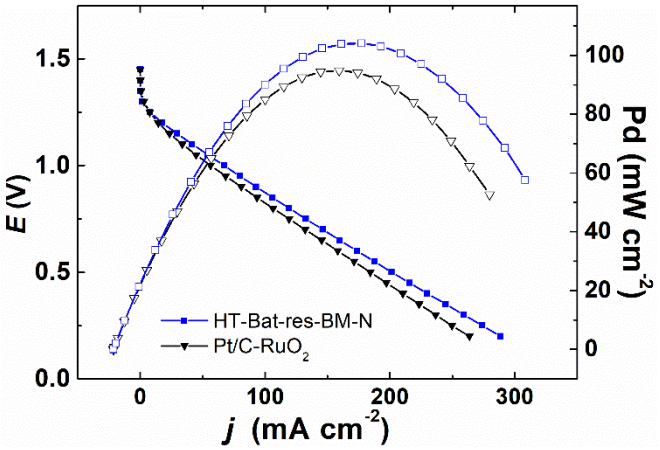

Figure 1. Discharge polarization curves and power density of novel graphite-based electrocatalyst compared to the Pt-C/RuO_2.

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