SusEReMat: Sustainable Electrochemical Recovery of Zn-Mn-O Materials from spent alkaline non-rechargeable batteries for rechargeable applications

Our increasing reliance on electronic devices has led to a significant amount of waste generated by alkaline non-rechargeable batteries – the ones we use every day in our remote controls, radios, or toys. However, these spent batteries contain valuable resources such as zinc metal and manganese oxides that can be recycled to create new rechargeable batteries. Unfortunately, current metal recovery processes for these resources involve high energy consumption, hazardous emissions, and high operating costs. That's where the SusEReMat research project comes in. The team involved in the project is developing an efficient and environmentally friendly electrochemical process for the selective recovery of Zn-Mn-O materials from spent alkaline batteries.

Electrochemical metal recovery has several advantages over traditional recycling methods. It requires significantly lower energy input, making it more cost-effective. The process kinetics and selectivity can be regulated by manipulating the current or potential of the electrolysis procedure to prepare the desired materials. This makes electrosynthetic techniques like cathodic electrodeposition valuable alternatives for metal recovery. The proposed process involves safely collecting spent batteries, discharging and dismantling them to separate the components, and then extracting target metals via chemical leaching. The team will then use electrochemical recovery to extract Zn and Mn from the resulting solution. By investigating the effect of various process parameters, such as electrolyte type, current density, and temperature, the team hopes to optimize the process conditions to maximize recovery efficiency while reducing energy consumption. The recovered Zn-Mn materials will be evaluated for their suitability for rechargeable battery applications, including their electrochemical performance, structural integrity, and long-term stability.

The successful development of novel electrochemical energy storage technologies is crucial in the transition towards sustainable and renewable energy and material ecosystems. The SusEReMat research project's integration of electrochemical recovery with sustainable materials reuse is a significant contribution to the advancement of circular economy principles in the battery industry. The outcomes of this research hold significant potential for advancing the sustainability of battery technologies, reducing reliance on raw materials, and facilitating the transition towards a more environmentally sustainable energy storage infrastructure.