ALTA 2023 27
30 April - 6 May | Perth, Australia

# LEWATIT® ION EXCHANGE RESINS FOR THE RECOVERY, REFINING AND RECYCLING OF CRITICAL BATTERY METALS

By

Dirk Steinhilber, [2]Lydia Tang, [2]Rajeev Bavaraju

LANXESS Deutschland GmbH, Liquid Purification Technologies, Koeln, Germany
[2] LANXESS Pty Ltd., Granville, NSW, Australia

Presenter and Corresponding Author

Dirk Steinhilber

## ABSTRACT

The growing demand for high purity battery lithium, nickel, cobalt and copper, requires efficient methods for the purification of those metals, to meet the high purity specifications of battery producers. Lewatit® ion exchange resins are crucial for many different metals processing applications. This paper will especially focus on the evolving application of the recycling of battery metals, which enables the reduction of carbon footprint and cost savings.

**Recycling and refining of battery metals**
Metal concentrates can be obtained by various operations e.g. hydrometallurgical mining of ores and recycling of cathode materials from lithium ion batteries (LIBs). Recycling of end of life batteries is based on battery discharge, mechanical separation and leaching of the black mass which is composed of graphite and Li, Ni, Co, Mn. The obtained concentrates often contain impurities like Al, Zn, Fe and Cu and need to be purified. High-purity metal concentrates can be produced by the use of selective Lewatit® resins. Selective chelating resins like Lewatit MDS TP 260, Lewatit® TP 272 and Lewatit® VPOC 1026 are especially suited for these separation tasks because of their high selectivity and loading capacity towards impurities, which ensures efficient removal below the specification limit. At the same time the resins show low interaction towards valuable and concentrated battery metals, which pass the resin bed in high yield and recovery.

**Recovery of battery metals**
The resin in pulp (RIP) technology is a very promising recovery approach, because battery metals can be extracted and concentrated from ore pulps, directly after leaching, without the need for CAPEX-intensive countercurrent decantation processes. To achieve high throughput within the continuous RIP process we developed our Lewatit® MonoPlus TP 209 XL. The resin shows high mechanical stability and low attrition rates which leads to savings in resin top-up demand. The large bead size up to 0.9 mm facilitates an efficient screening and sieving during resin-feed separation once the loading cycle is completed. Recovery of nickel in presence of high concentrations of ferric and cobalt can be achieved with Lewatit® MDS TP 220. Thanks to its small size and, in turn, short diffusion paths, the resin exhibits fast kinetics during exchange and regeneration. This results in higher capacity utilization and longer service lives with lower chemical requirements for regeneration as compared to conventional resins.

**Waste water treatment**
Waste water streams generated by battery metals processing plants can for instance be efficiently treated by Lewatit® MonoPlus TP 207. This resin selectively removes toxic heavy metals in the presence of high concentrations of other constituents of the waste water, e.g., hardness. Valuable heavy metals can additionally be recovered and recycled from the resin by selective regeneration.

In conclusion Lewatit® ion exchange resins provide benefits including up to two times longer cycle times compared to conventional resins combined with savings on regeneration chemical costs. Excellent exchange kinetics ensures contaminant removal down to trace levels and yields pure battery metal concentrates. Additionally, Lewatit® chelating resins possess high resilience towards osmotic and mechanical stress and ensure long resin lifetimes.

*Keywords: Selective Lewatit® chelating resins, recovery, refining and recycling of battery metals*