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LEWATIT® CHELATING AND SOLVENT IMPREGNATED ION EXCHANGE RESINS FOR THE RECOVERY AND REFINING OF BATTERY METALS

By

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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. The application of Lewatit®s chelating and solvent impregnated ion exchange resins to the recovery and refining of battery metals is described in this paper.

Recovery of high purity battery metals with chelating resins

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 chelating resin Lewatit® MonoPlus TP 209 XL. The resin shows high mechanical stability which leads to savings on resin inventory. Large bead size up to 0.9 mm allows high throughput in the metal loading cycle by efficient screening and sieving during resin-feed separation. Recovery of nickel in presence of high concentrations of ferric and cobalt can be achieved with chelating resin 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.

Purification of battery metals with solvent impregnated resins

Metal concentrates can be obtained by various operations e.g. hydrometallurgical mining of ores and recycling of cathode materials from lithium ion batteries (LIBs). These concentrates often contain impurities and need to be purified. Solvent Impregnated Resins (SIR) Lewatit® TP 272 and Lewatit® VPOC 1026 are especially suited for this critical role because of their high selectivity and loading capacity towards impurities, which ensures efficient removal below the specification limit. At the same time these SIR show low interaction towards valuable and concentrated battery metals nickel and cobalt, which pass the resin at high yield and recovery. SIR are composed of special macroporous crosslinked polymeric beads with a solvent extractant adsorbed and immobilized on the surface and within the pores. The special production procedure of Lewatit® SIR allows the formation of homogeneously distributed extractant, leading to higher operating capacities and faster exchange kinetics than for conventional SIR resins. SIR combine the advantages of ion exchange resins (low capital cost and plant footprint, simple maintenance) with the unique and enhanced metal selectivity of solvent extraction.

Waste water treatment with chelating resin

Waste water streams generated by battery metals processing plants, e.g., mining tailings, can be efficiently treated by Lewatit® MonoPlus TP 207. This chelating 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 these 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: Chelating and Solvent Impregnated Lewatit® ion exchange resins, recovery, refining and recycling of battery metals