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Increased Energy Efficiency and Improved Product Quality in Processing of Lithium Bearing Ores by Applying Fluidized-Bed Calcination Systems

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Abstract : For the production of lithium carbonate or hydroxide out of lithium bearing ores, a thermal activation (calcination/decrepitation) is required for the phase transition in the mineral to enable an acid respectively soda leaching in the downstream hydrometallurgical section. In this paper, traditional processing in Lithium industry is reviewed, and opportunities to reduce energy consumption and improve product quality and recovery rate will be discussed. The conventional process approach is still based on rotary kiln calcination, a technology in use since the early days of lithium ore processing, albeit not significantly further developed since. A new technology, at least for the Lithium industry, is fluidized bed calcination. Decrepitation of lithium ore was investigated at Outotec's Frankfurt Research Centre. Focusing on fluidized bed technology, a study of major process parameters (temperature and residence time) was performed at laboratory and larger bench scale aiming for optimal product quality for subsequent processing. The technical feasibility was confirmed for optimal process conditions on pilot scale (400 kg/h feed input) providing the basis for industrial process design. Based on experimental results, a comprehensive Aspen Plus flow sheet simulation was developed to quantify mass and energy flow for the rotary kiln and fluidized bed system. Results show a significant reduction in energy consumption and improved process performance in terms of temperature profile, product quality and plant footprint. The major conclusion is that a substantial reduction of energy consumption can be achieved in processing Lithium bearing ores by using fluidized bed based systems. At the same time and different from rotary kiln process, an accurate temperature and residence time control is ensured in fluidized-bed systems leading to a homogenous temperature profile in the reactor which prevents overheating and sintering of the solids and results in uniform product quality.

Keywords : calcination, decrepitation, fluidized bed, lithium, spodumene
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