

Extraction of Lithium from Spodumene through Roasting with Additives

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ABSTRACT

The demand for lithium chemicals continuous to grow, motivated by its use in batteries for electric vehicles and energy storage. High cost of reagents (H_2SO_4 , $\text{Ca}(\text{OH})_2$) and energy of the acid roast process in the conventional lithium extraction process has motivated this study, which focuses on developing an alternative to eliminate the acid roast process from the traditional flowsheet. This work evaluated the use of potassium sulfate in the calcination stage to react with α -spodumene to form water soluble lithium species. Roasting α -spodumene and potassium sulfate at 1050 °C for 2 hours at a ratio of 1:0.6-1, resulted in the formation of leucite (KAlSi_2O_6) and potassium lithium sulfate (KLiSO_4). Leaching these calcines with water at 105 °C resulted in the dissolution of KLiSO_4 , achieving lithium recovery above 90 %, but KAlSi_2O_6 remained in the residue. At lower spodumene to K_2SO_4 ratios of 1:0.4, unreacted beta-spodumene was observed, and this led to lower leaching of lithium (63 %). Lowering roasting temperature to 1000 °C had no effect on recovery, but lowering roasting time to 1 hour whilst maintaining the roasting temperature at 1000 °C reduced the lithium leaching drastically to approximately 20 %. As a result, roasting over 2 hours was optimised at 1000 °C and a ratio of spodumene to potassium sulfate at 1:0.6.

Keywords: Roasting, Sulfation, Lithium, Leaching, Spodumene