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Thermochemical Modelling for Extraction of Lithium from Spodumene and Prediction of Promising Reagents for the Roasting Process

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Abstract : Spodumene is a lithium-bearing mineral of great interest due to increasing demand of lithium in emerging electric and hybrid vehicles. The conventional method of processing the mineral for the metal requires inevitable thermal transformation of α-phase to the β-phase followed by roasting with suitable reagents to produce lithium salts for downstream processes. The selection of appropriate reagent for roasting is key for the success of the process and overall lithium recovery. Several researches have been conducted to identify good reagents for the process efficiency, leading to sulfation, alkaline, chlorination, fluorination, and carbonizing as the methods of lithium recovery from the mineral.HSC Chemistry is a thermochemical software that can be used to model metallurgical process feasibility and predict possible reaction products prior to experimental investigation. The software was employed to investigate and explain the various reagent characteristics as employed in literature during spodumene roasting up to 1200°C. The simulation indicated that all used reagents for sulfation and alkaline were feasible in the direction of lithium salt production. Chlorination was only feasible when Cl2 and CaCl2 were used as chlorination agents but not NaCl nor KCl. Depending on the kind of lithium salt formed during carbonizing and fluorination, the process was either spontaneous or nonspontaneous throughout the temperature range investigated. The HSC software was further used to simulate and predict some promising reagents which may be equally good for roasting the mineral for efficient lithium extraction but have not yet been considered by researchers.

Keywords : thermochemical modelling, HSC chemistry software, lithium, spodumene, roasting
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