Co-extraction of aluminum and silicon and kinetics analysis in carbochlorination process of low-grade bauxite

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Abstract: Addressing the issue that the Bayer process is not suitable for low-grade bauxite, carbochlorination was proposed to recover aluminum and silicon from low-grade bauxite. This study focused on the behavior of aluminum and silicon during the carbochlorination process of low-grade bauxite. The impact of various process parameters on the chlorination efficiency was investigated, and the chlorination mechanism and kinetics of aluminum and silicon chlorination in bauxite were analyzed and discussed. Under optimal experimental conditions, the chlorination efficiency of Al_2O_3 and SiO_2 reached 94.93% and 86.32%, respectively. The carbochlorination of aluminum and silicon in bauxite adhered to a shrinking, unreacted core model governed by gas diffusion within the product layer. This process can be bifurcated into two stages. Additionally, calculations were conducted to determine the apparent activation energy and reaction order of the chlorination processes involving Al_2O_3 and SiO_2. Examining the chlorination mechanism revealed that the bauxite carbochlorination encompasses transformations among various minerals. Notably, the aluminum component prefers to participate in the carbothermal chlorination reaction over silicon.

Keywords: Low-grade bauxite, Carbochlorination, Extraction of aluminum and silicon, Kinetic study, Resource utilization

Biography: Dr. Zhao Xinxin is committed to the exploration of resource utilization, particularly in the comprehensive use of metallurgical mineral solid waste and non-traditional aluminum resources. She employs a chlorination-oxygen pressure conversion method to extract valuable elements from low-grade bauxite, thereby offering an innovative approach for the comprehensive exploitation of such aluminum resources that are unsuitable for Bayer process treatment.

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