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Enhanced discharge performance of electrolytic manganese anode slime using calcination and pickling approach

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Abstract:

Electrolytic manganese anode slime (EMAS) is a solid waste found in the anode chamber during the production of electrolytic manganese metal, which mainly contains high concentration of manganese and other impurities. In EMAS, $\gamma\text{-MnO}_2$ and $\delta\text{-MnO}_2$ turned into $\alpha\text{-MnO}_2$ after calcination, and the oxide can be dissolved by pickling. The results showed that the specific surface area of EMAS increased from $33.11\text{ m}^2\cdot\text{g}^{-1}$ to $93.53\text{ m}^2\cdot\text{g}^{-1}$, and the micropore volume increased from $0.0129\text{ cm}^3\cdot\text{g}^{-1}$ to $0.0362\text{ cm}^3\cdot\text{g}^{-1}$, as well as the specific capacity and the Open Circuit Voltage (OCV) of EMAS were $249.65\text{ mAh}\cdot\text{g}^{-1}$ and 1.60 V , respectively, under the condition of calcination temperature $400\text{ }^\circ\text{C}$, calcination time 1 h , sulfuric acid $1\text{ mol}\cdot\text{L}^{-1}$, pickling temperature $25\text{ }^\circ\text{C}$, pickling time 0.5 h , and liquid-to-solid ratio $8:1$.

Keywords: electrolytic manganese anode slime; calcination; pickling; discharge performance

1 Introduction

In recent years, China has been the top contributor in global electrolytic metal manganese production, accounting for over 98.5% of the total world capacity in 2016 (1.17 million tons) [1-6]. Electrolytic manganese anode slime (EMAS) is a solid waste found in the anode chamber during the production of electrolytic manganese metal [7-10]. Producing 1 ton of electrolytic metal manganese would generate 50–150 kilogram of EMAS using current electrolytic technology [11,12]. In China, EMAS was hardly used as an additives in steel making, and the vast majority

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