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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, γ-MnO_2 and δ-MnO_2 turned into α-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 $m^2 \cdot g^{-1}$ to 93.53 $m^2 \cdot g^{-1}$, and the micropore volume increased from 0.0129 $cm^3 \cdot g^{-1}$ to 0.0362 $cm^3 \cdot g^{-1}$, as well as the specific capacity and the Open Circuit Voltage (OCV) of EMAS were 249.65 $mAh \cdot g^{-1}$ and 1.60 V, respectively, under the condition of calcination temperature 400 °C, calcination time 1 h, sulfuric acid 1 $mol \cdot L^{-1}$, pickling temperature 25 °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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