

Mechanically Compressed Graphite-Clay Composite Electrode for High-Temperature Applications

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The graphite-clay based electrodes have been received escalating attention very recently. Graphite based electrodes typically use as an anode in high-temperature molten salt deoxidation of minerals. The major objective is to fabricate mechanically compressed electrodes using local graphite and kaolinite to improve electrical conductivity, mechanical strength, thermal stability and durability. The composites were prepared by mixing different ratios of graphite and kaolinite (20:80, 40:60, 50:50, 60:40 and 80:20) followed by continuous stirring of the content for 1 hr at the rate of 1100 rpm. The fabrication of rod-shaped electrodes (length and diameter are around 3.00×10^{-2} m and 1.00×10^{-2} m, respectively) was achieved by pressing 8.50×10^{-3} kg of composite material (under 1.03×10^4 N ram force) using a specially designed stainless steel mould. The resistivity of electrodes was measured before and after the firing of electrodes at around 823 K for 1 hr duration. Results indicate that the fabricated electrodes are very good electrical conductors with considerably low resistivity. The resistivity of fired electrodes is lower than the unfired electrodes. The electrode containing 80% of graphite (fired electrode) is attributed to the lowest resistivity ($7.80 \times 10^{-4} \Omega \text{ m}$) and vice versa for the electrode containing 20% of graphite ($5.80 \times 10^{-2} \Omega \text{ m}$). It is also evident that the resistivity of fabricated electrodes is somewhat decreased exponentially with the increased amount of graphite. The fired electrodes are very stable in both molten salts and aqueous solutions over unfired electrodes that eventually failed to endure in the aqueous medium at room temperature. The fired electrodes are capable of withstanding the temperatures up to 1473 K which ensures improved thermal stability. The low resistivity, uniform matrix, higher strength, superior thermal stability, and durability are the salient features of the newly fabricated compressed graphite-kaolinite composite electrode.

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