Short Communication

Electrosynthesis of Iron-based ZrC Nanocomposite Powder in Molten Salt

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Iron-based ZrC nanocomposite powder is synthesized by using a simple electrochemical deoxidation process in $\text{CaCl}_2\text{-NaCl}$ molten salt. Herein, the electrolysis is conducted at a constant potential using a graphite anode and a cost-effective $\text{ZrSiO}_4/\text{Fe}_2\text{O}_3/\text{carbon}$ cathode. The reaction pathway of electrosynthesis is systematically investigated by examining the composition and microstructure of partially- and fully-reduced electrolytic products. The results reveal that the composition of Fe-based metallic phases in the final product can be controlled by adjusting the amount of Fe_2O_3 in the cathode precursor. Moreover, the formation of FeSi-ZrC composite is realized through the formation of calcium-containing intermediate phases, such as CaZrO_3 , $\text{Ca}_x\text{Zr}_{1-x}\text{O}_x$ and Ca_2SiO_4 , oxycarbide phase, i.e., $\text{ZrC}_x\text{O}_{1-x}$, and Fe-Si intermetallics (Fe_3Si and Fe_5Si_3). The current study demonstrates the promise of electrochemical synthesis route for the fabrication of iron-based ZrC nanocomposites.

Keywords: Iron-based composite; ZrC; electrochemical synthesis; ZrSiO_4 ; molten salt

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