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A novel method for vanadium slag comprehensive utilization to synthesize Zn-Mn ferrite and Fe-V-Cr alloy

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Highlights

- Vanadium slag was applied in synthesis of Zn-Mn ferrite and Fe-V-Cr alloy deposits.
- Mn-Zn ferrites were directly synthesized without the presintering process.
- The impurities CaO and SiO₂ segregated to the grain boundaries resulting in increasing the resistivity of ferrite.
- The enrichment ratio of V (Cr or Ti) reached 48%.

Abstract

Vanadium slag is a by-product from steelmaking process of vanadium-titanium magnetite, which mainly contains FeO, MnO, V₂O₃, and Cr₂O₃. The elements Fe and Mn are major components of Mn-Zn ferrite. The elements V and Cr are major components of V-Cr alloy. In view of the potential application in these study, a Mn_{0.8}Zn_{0.2}Fe₂O₄ of high saturation magnetization (M_s=68.6 emu/g) and low coercivity (H_c=3.3 Oe) was successfully synthesized from the leaching solutions of vanadium slag by adding appropriate chemical reagents, ZnCl₂ and MnCl₂·4H₂O, via roasting at 1300°C for 1h. The minor components (CaO and SiO₂) in the leaching solution of vanadium slag segregated to the grain boundaries resulting in increasing the resistivity of ferrite. The value of DC resistivity of Mn_{0.8}Zn_{0.2}Fe₂O₄ at 25°C reached 1230.7Ω·m. The residue containing Fe, V and Cr was chlorinated by AlCl₃ and the Fe³⁺, V³⁺, and Cr³⁺ ions were released into the NaCl-KCl eutectic. The current-time curve for the electrolysis of molten salt was investigated. Alloy (Fe, V, and Cr) of granular shape was obtained. The residue can be used to produce the mulite. This process provided a new approach to utilize slag from steelmaking.

Key words: Vanadium slag, Ammonium chloride, Mn-Zn ferrite, Alloy

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