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Determination of Conversion Reaction Mechanism of Celestite to Acid Strontium Oxalate Hydrate in Aqueous Solution of $\text{H}_2\text{C}_2\text{O}_4$

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Abstract

One of the most important steps to obtain high-temperature superconductive and self-activated luminescence strontium compounds is the production of strontium oxalate as precursor. The aim of this study is to determine the conversion reaction mechanism of celestite to acidic strontium oxalate hydrate in solutions obtained by dissolving $\text{H}_2\text{C}_2\text{O}_4$ in distilled water. The effect of temperature on the conversion reaction mechanism using excess amounts of $\text{H}_2\text{C}_2\text{O}_4$ with respect to the conversion reaction stoichiometry was determined.

The conversion of celestite to acidic strontium oxalate in $\text{H}_2\text{C}_2\text{O}_4$ solutions proceeds in two consecutive reaction steps. In the first step, $\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ is formed and in the second, $\text{H}[\text{Sr}(\text{C}_2\text{O}_4)_{1.5}(\text{H}_2\text{O})]$ is formed. The conversion reaction ends by the formation of $\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ on the surfaces of the celestite particles. The saturation concentration of $\text{H}[\text{Sr}(\text{C}_2\text{O}_4)_{1.5}(\text{H}_2\text{O})]$ chelate compound decreases during cooling of the solution and the excess amount of $\text{Sr}(\text{HC}_2\text{O}_4)(\text{C}_2\text{O}_4)_{0.5} \cdot \text{H}_2\text{O}$ crystallizes. XRD, ICP - OES and simultaneous TG / DTA – MS analytical techniques were used to explain the conversion reaction mechanism.

Keywords

Celestite; Oxalic Acid; Acid Strontium Oxalate; Conversion Reaction; Chelate

Introduction

One of the most important steps to obtain strontium compounds is the production of strontium oxalate as precursor. The structure must be homogeneous, without any alkali cation contamination and with a definite chemical composition. This is required particularly in the production of Bi-Sr-Ca-Cu-O (BSCCO) high-temperature superconductive materials (Knaepen et al., 1998). The formation of different types of strontium oxalate hydrate compounds [neutral ($\text{SrC}_2\text{O}_4 \cdot x\text{H}_2\text{O}$) or acidic ($\text{Sr}(\text{HC}_2\text{O}_4)(\text{C}_2\text{O}_4)_{0.5} \cdot \text{H}_2\text{O}$)] depends on oxalate source and production conditions such as pH and temperature of the solution. Drying time of the precipitate is another important parameter that need to be controlled (Vanhoyland et al., 2001).

Previous studies have focused on co-precipitation of metal oxalates from nitrate solutions of the elements present in the system of Bi-Sr-Ca-Cu using $\text{H}_2\text{C}_2\text{O}_4$ and $(\text{NH}_4)_2\text{C}_2\text{O}_4$ solutions

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