REUSE OF MAGNESIUM WASTES IN HYDROTHERMAL SYNTHESIS OF A MAGNESIUM BORATE MINERAL: ADMONTITE

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Abstract

Magnesium wastes are among the gradually ascending and therefore challenging metal wastes, which are produced by many industrial activities. The purpose of this study is the usage of magnesium waste, a raw material in magnesium borate production by hydrothermal synthesis. Boron sources (boric acid (H₃BO₃) and boron oxide (B₂O₃)) react with magnesium wastes in order to synthesize the magnesium borate mineral of admontite (MgO(B₂O₃)₃ꞏ7(H₂O)). In addition to the synthesis from waste magnesium, magnesium oxide (MgO) and B₂O₃ are also used to produce magnesium borates, in order to compare the results. Techniques of X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), Raman spectroscopy and scanning electron microscopy with energy dispersive (SEM-EDX) are used for further characterization analysis. The products’ boron oxide contents and overall yields are also calculated. According to the results, synthesized minerals are identified as admontite (MgO(B₂O₃)₃ꞏ7(H₂O)), mcallisterite (Mg₃(B₂O₄(OH))₂ꞏ9(H₂O)) and magnesium borate hydrate (MgB₂O₅(OH)₃ꞏ3(H₂O)). It is seen that magnesium borates could be obtained as a mixture of different types of magnesium borate minerals or pure magnesium borate. A pure magnesium borate mineral of admontite is synthesized at the reaction temperature of 100°C and the reaction time of 240 minutes using magnesium waste (W) and both H₃BO₃ (W) and B₂O₃ (B). B₂O₃ content and overall yields of pure admontite for the W-H were found as 51.15 ± 0.52% and 81.45 ± 3.20%, respectively. Similarly, pure admontite synthesized from W-B have the 51.72 ± 0.52% of B₂O₃ content and 74.56 ± 3.20% overall reaction yield.

Key words: admontite, hydrothermal synthesis, magnesium borate, magnesium waste, overall yield

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