Effect of microwave sintering on microstructure development of barium hexaferrite using sol-gel technique

ABSTRACT

Magnetic materials can be regarded now as being indispensable in modern technology. They are components of many electromechanical and electronic devices. Permanent magnet materials are essential in devices for storing energy in a static magnetic field. Hard magnetic materials are important electronic materials that have a wide range of industrial and commercial applications. Hexagonal Ferrites have the formula M (Fe12O19), where M is usually barium (Ba), strontium (Sr), or lead (Pb). The crystal structure is complex, but it can be described as hexagonal with a unique ćĉô axis or vertical axis. This is the easy axis of magnetization in the basic structure. Because the direction of magnetization cannot be changed easily to another axis, hexagonal ferrites are referred to as hard. M-type Barium hexaferrite (BaFe12O19), is of great importance as permanent magnets, particularly for magnetic recording as well as in microwave devices. Barium ferrite was synthesized by sol-gel from aqueous mixed solutions of ferric nitrate and barium nitrate and D-Fructose. The resultant products are investigated by X-ray diffractometer (XRD), High resolution scanning electron microscopy (HR-SEM) and vibrating sample magnetometer (VSM). At the sintering temperature 1150°C, single phase of barium hexaferrite (BaFe12O19) dence ceramics were formed. Regarding the grain size, it can be seen that, the minimum particle size appeared at 1000°C, and the maximum size was found at 1150 °C, which most likely explained by the formation of the dense single phase of barium hexaferrite (BaFe12O19). The SEM results showed that the grains were regular hexagonal platelets. In addition, saturation magnetization (51.88 Am2/kg) was observed at sintering temperature 1150°C, even sub micrometer grain size under the optimum condition. However, it was found that the coercivity (Hc) 5594.8 Oe of the sintered BaFe12O19 samples were lower than the theoretical values. Whose results indicate that they have well-formed crystalline phase of BaFe12O19 dense hexagonal platelet-like ceramics.

Keyword: Sol-gel method; Hexaferrite; Structural property; Magnetic property