ABSTRACT

Topochemical sintering of barium and strontium hexaferrite

This work describes the method of preparation of Ba and Sr hexaferrites which can be used as permanent magnets. The process of topochemical sintering in air and vacuum is described in this work. The techniques for producing anisotropic ferrites are also described.

The present work had two main aims namely :

1. To study the effect of air/vacuum ambients on the orientation of grains during topochemical sintering of barium hexaferrites.

2. To study the solid state topochemical reactions associated with topochemical sintering of barium and strontium hexaferrites in air.

The topochemical sintering of $BaCO_3.12FeOOH$ in air is characterized by dissociation of α.FeOOH in the temperature range of 240 - 440°C and decomposition of $BaCO_3$ --> $BaO_{(s)} + CO_{2(g)}$ in the temperature range of 660-720°C. Further heating to a temperature 900-1150°C brings about complete ferritization of green pellets. Similar transformation critical point for the system $SrCO_3.12FeOOH$ raw material has been identified in the temperature range of RT-1200°C.

Unidirectional compaction of $BaCO_3.6Fe_2O_3$ powder mix has been used under controlled condition to achieve 68% orientation of the grains in the sintered body. A completely homogenized sintered body with an average grain size of 0.19 μm and 0.93 μm length is observed in the microstructure which is close to the critical domain size of the barium hexaferrite compound. It has been possible to produce barium hexaferrite with magnetic properties comparable with best commercially available isotropic magnets.

The use of vacuum during topochemical sintering produces better orientation of grains and magnetic properties in the sintered body. The experimental condition required to achieve the best results are described.

The nonisothermal TMA sintering data of $BaCO_3.6Fe_2O_3/BaCO_3.12FeOOH$ in the temperature range of 1000-1573 K in air, fits into an equation of the type $\ln(\Delta L/L)^{0.8} \times 1/T^2 = K/T + C$.

The isothermal TMA sintering data of $BaCO_3.12FeOOH$ and $SrCO_3.12FeOOH$ in vacuum atmosphere at 1323 K follows Kingery Berg equation.

Key words : Hexaferrite, Topochemical sintering, Densification, Magnetization