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Study of the structural and magnetic properties of the Ba_2FeZrO_{6-x} complex perovskite in nanosized form

L. T. Corredor[(1,2)*], D.A. Landínez Téllez[(2)], J. Roa-Rojas[(2)] and J. Albino Aguiar[(1)]

(1) Laboratório de Supercondutividade e Materiais Avançados, Universidade Federal de Pernambuco, Recife-PE, Brasil, e-mail: ltcorredorb@unal.edu.co
(2) Grupo de Física de Nuevos Materiales, Departamento de Física, Universidad Nacional de Colombia, AA 14490, Bogotá D.C., Colombia
* Corresponding author.

Abstract – This work presents the production of barium iron zirconate, a complex perovskite oxide for the first time, to the best of our knowledge, by a novel production method of nanosized powders, involving combustion synthesis from mixture of nitrates and fuel. The morphological properties of the nanopowders were studied by scanning electron microscopy (SEM) and BET surface area determination. The sintered samples were characterized by X-ray powder diffraction and energy dispersive X-ray analysis. Magnetic ac susceptibility and dc magnetization measurements reveal a paramagnetic behavior. Implications of these results are discussed, and possible applications of the new perovskite are proposed.

In recent years, a several nanosized shaped perovskite type materials had been produced for several applications, such as catalyst materials, electrochemical devices, fuel cells and even gas sensors [1]. The most common methods for the production of nanoparticle oxides are sol-gel, spray pyrolysis, coprecipitation and combustion [2]. The last one has been adopted in the last years, due to the experimental and economic facilities that it provides. This method uses oxidizers and a fuel, which is a rapid way and, depending on the application, lower sintering temperatures for shorter time are needed. The composes Ba_2REZrO_{6-x} (RE: Eu,Y,Ce,Yb,La) belong to a complex type perovskite family that has been investigated in last years [3] for their potential application as a possible substrate for High Tc superconductors. The best results results were obtained with a modified combustion technique where the fuel is substituted by ammonia and the complexing agent by citric acid, instead of urea and PVA respectively. As part of our research program in perovskite oxides [4], this paper propose the novel perovskite Ba_2FeZrO_{6-x}, with the aim of optimize the properties and possible applications of the Ba_2REZrO_{6-x} family by improving the combustion synthesis. The morphological properties of the nanopowders were studied by scanning electron microscopy (SEM) and BET surface area determination, which confirm a crystallite typical size of 150 nm. The sintered samples were characterized by X-ray powder diffraction and energy dispersive X-ray analysis. The results of XRD were analyzed by Rietveld method with GSAS software. The crystal structure at room temperature of the compound was determined as cubic, with lattice parameter a=8,310(2) Å. Magnetic ac susceptibility and dc magnetization measurements reveal a paramagnetic behavior. Implications of these results are widely discussed, the advantages of the synthesis method are pointed, and possible applications of the new perovskite are proposed.

References

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