ABSTRACT

This study is based on the fabrication of Bismuth ferrite nanostructure by the partial replacement of transition metals like Lanthanum, Yttrium and Zirconium. The porous alumina AAO template was used as substrate and metal nanostructures were synthesized on templates by Sol-gel and Hydrothermal Techniques. Two step anodization was used to fabricate the hexagonally ordered porous alumina template. The pore diameter and interpore distance can be controlled by appropriately changing the anodization conditions and pore widening time. Various acidic electrolytes were used for the anodization of aluminum samples. The anodized AAO-template interpore distances ranges from ten to several hundred nanometers. This thesis mainly consists of three parts:

1) Anodization of aluminum by two step anodization.
2) Growth of Bismuth ferrite (BFO) nano-structure on AAO-template.
3) Doping of transition metal like Lanthanum, Yttrium and Zirconium by partial replacement of BFO on AAO-template.

The Bismuth ferrite nano-particles were prepared by using low cost application oriented Sol-gel and Hydrothermal techniques. Various techniques were employed to characterize the synthesized nano-materials such as X-ray diffraction (XRD), Field emission scanning electron microscopy (FESEM), ultraviolet–visible (UV–Vis) spectrophotometry, Energy Dispersive X-rays Spectroscopy (EDX) and Quadtech Precision 1910 LCR meter for the study of dielectric and optical properties. For the simulation we have used ANSYS and MATLAB software's for the comparison of experimental results with the theoretical values. The results show that the prepared nano-structures were used for the energy storage application.

It is concluded that the value of band gap decreases from 2.26eV to 2.02 eV and the value of dielectric permittivity increases from 19 to 159 with comparatively low tangent loss value due to the growth of Yttrium nanostructures on AAO template. Due to the growth of BFO and Zr-BFO nanostructures on AAO template the value of band gap decreases from 2.76 eV to 1.81 eV, the dielectric permittivity increases from 17 to 187 with the relative low tangent loss value. Similarly, the value of band gap decreases from 2.4eV to 2.26 eV and 2.23 eV with the growth of Lanthanum doped BFO nanostructures on nano-porous AAO-template. The results show that these templates are excellent source for energy storage devices.