

## PREPARATION OF $\text{BaTiO}_3$ NANOTUBE ARRAYS, $\text{CoFe}_2\text{O}_4$ NANOPARTICLES AND THEIR COMPOSITE

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Multiferroic nanocomposites which possess both ferroelectric and ferromagnetic properties are attracting much attention because of their scientific interest and significant technological promise in the novel multifunctional devices. Gas-phase syntheses have been typically used to fabricate multiferroic nanocomposites [1]; however, high production cost has been hindering further expansion of the research field. In this research, the components of multiferroic nanocomposites are fabricated by anodization and hydrothermal treatment which were then used to fabricate multiferroic nanocomposites through electrophoretic deposition (EPD) as cheaper alternatives to the costly gas-phase processes.

$\text{TiO}_2$  nanotubes arrays were firstly formed on Ti metal foils by anodization in an electrolyte containing ethylene glycol, dimethyl sulfoxide, ammonium fluoride and water. Then,  $\text{BaTiO}_3$  nanotube arrays were obtained by hydrothermal treatment of  $\text{TiO}_2$  nanotube arrays using Ba-containing aqueous solution. The morphologies and crystal structure of  $\text{BaTiO}_3$  nanotube arrays were analyzed by a scanning electron microscope (SEM) and an X-ray diffractometer (XRD).

Fig. 1A shows the SEM images of  $\text{TiO}_2$  nanotube arrays prepared by anodization of Ti metal foils. Vertically aligned  $\text{TiO}_2$  nanotubes with uniform length and diameter were fabricated on the surface of Ti. Fig. 1B shows SEM images of  $\text{BaTiO}_3$  nanotube arrays obtained after hydrothermal treatment of  $\text{TiO}_2$  nanotube arrays. It was found that the nanotube arrays could withstand the harsh conditions of hydrothermal treatment. XRD analysis revealed that amorphous  $\text{TiO}_2$  were converted to tetragonal  $\text{BaTiO}_3$  through the hydrothermal treatment.

Meanwhile,  $\text{CoFe}_2\text{O}_4$  nanoparticles were synthesized by hydrothermal treatment of a mixture containing  $\text{FeSO}_4$ ,  $\text{CoCl}_2$ ,  $\text{NaOH}$ , cetyltrimethylammonium bromide and water. The obtained nanoparticles were deposited onto  $\text{BaTiO}_3$  nanotube arrays via EPD. The results will be presented and discussed at the conference site.

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[1] N.M. Aimon, D.H. Kim, X.Y. Sun, C.A. Ross, ACS Appl. Mater. Interfaces, 7, 2263 (2015).

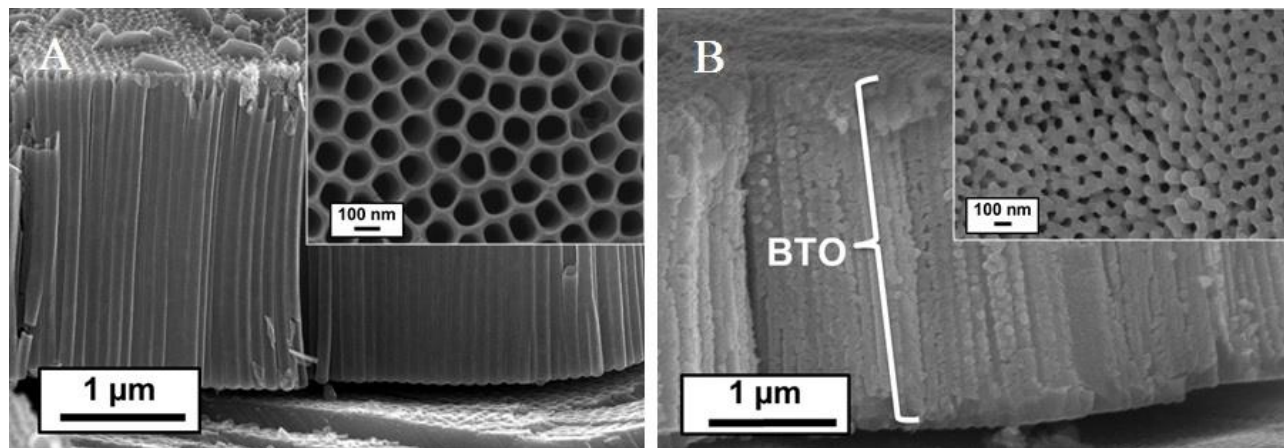


Fig. 1 SEM images of (A)  $\text{TiO}_2$  nanotube arrays and (B)  $\text{BaTiO}_3$  nanotube