Structural and Optical Properties of $NiTiO_3$ Synthesized by Polymeric Precursor Method

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$NiTiO_3$ with ilmenite structure were widely investigated for their photophysical, acoustic-optic, dielectric, magnetic, catalytic and gas-sensing properties. Fine powders reveal particularly optical and electrical properties in comparison with bulk materials. Powders of ilmenite nickel titanate ($NiTiO_3$) were prepared by the polymeric precursor method based on a modified Pechini process at a relatively lower temperature. This method allows smaller grains, larger specific surface area, and narrow particle size distribution. In this study, titanium isopropoxide, and nickel acetate were separately dissolved in ethanol, and added to citric acid(CA)-ethanol solution at room temperature. The mixture, with a molar ratio Ni/Ti/CA=1/1/1, was heated at 70ºC for several hours until the agglomerate precursor formed and the organic precursor was calcined at 400-900°C for 3 hrs in air. X-ray diffraction (XRD) indicated that pure-phase of yellow $NiTiO_3$ powders were obtained as the precursor calcined above 600ºC. The powders are spherical-shape grains with the size in the range of 50-250 nm. The DTA curve shows two exothermic peaks at 300ºC and 347ºC, which is the points of the decomposition of organic compound and crystallization of $NiTiO_3$ phase. The samples calcinated at 600 and 700ºC have the specific surface area of 22.0 m^2/g and 11.1 m^2/g corresponding to the grain size of 50 and 100 nm, respectively. The UV-vis spectra shows two absorption peaks at 448 nm and 510 nm. The intensity of absorption peaks increases with the raising temperatures.

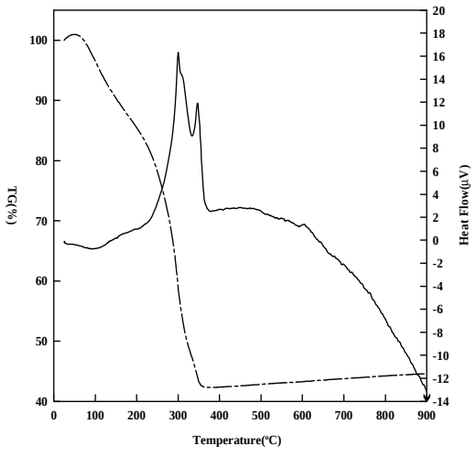

Fig. 1. TG/DTA curves of the nickel titanium citrate precursor at a heating rate of 5ºC/min.

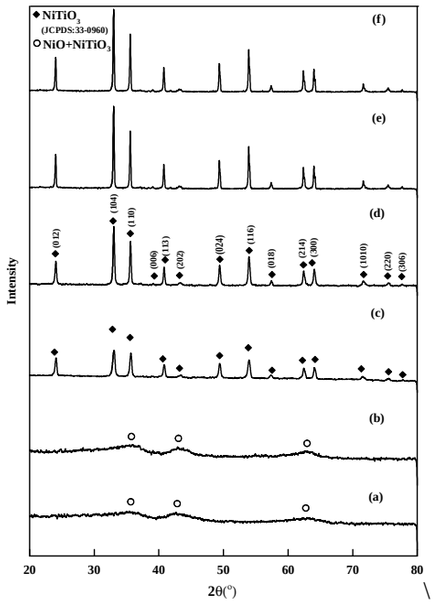

Fig. 2. X-ray diffraction patterns of nickel titanium citrate precursor calcined at (a) 400ºC; (b) 500ºC; (c) 600ºC; (d) 700ºC; (e)800ºC; (f) 900ºC for 3 hours in air.

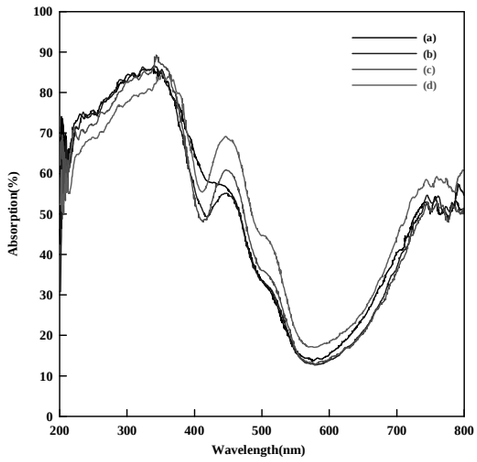

Fig. 3. UV-vis diffuse spectra of $NiTiO_3$ powders calcined at (a) 600°C; (b) 700ºC; (c) 800ºC; (d) 900ºC for 3 hours in air.