Solution combustion synthesis of nanosized ferroelectric (1-x)$KNbO_3$-x($BaNb_{1/2}Ni_{1/2}O_{3-\delta}$): characterization, mechanism and photocatalytic properties

S. Abhinay, R. Mazumder*

Department of Ceramic Engineering, National Institute of Technology, Rourkela, Odisha-769008, India

*E-mail: rana_brata@hotmail.com, ranabrata@nitrkl.ac.in

Abstract

The present paper reports the synthesis of (1-x)$KNbO_3$-x($BaNb_{1/2}Ni_{1/2}O_{3-\delta}$) (x = 0, 0.05, 0.1 and 0.15) [KBNNO] by solution combustion method using citric acid as the fuel. The effect of fuel-to-oxidizer ratio (Φe) (0.6-1.0) in the combustion process and phase evolution has been studied. For the first time, we report that the phase purity can be achieved at room temperature by controlling the fuel to oxidizer ratio of the starting solution. X-ray diffraction and Raman spectroscopy clearly show the phase transition from orthorhombic to cubic phase with increase in doping concentration (x > 0.1). FESEM and TEM have been used to determine the morphology of the powder. UV-Vis absorption spectroscopy indicates that KBNNO have significant absorption in the visible range when compared with $KNbO_3$ synthesized under same conditions. Photocatalytic activity evaluation displays an enhanced visible light photocatalytic activity of KBNNO in degrading rhodamine B in comparison with $KNbO_3$.

Keywords: $KNbO_3$; Doping;

References

1. S. Yang, et al. Nature Nanotechnol. 5, (2010) 143
2. D. Cao, et al. Nano Lett. 12, 2803–2809 (2012).
3. I. Grinberg, et al., Nature 503 (2013) 509
4. A. M. Rappe, et al. US Patent 2013/0104969