Structural, dielectric properties and photo-catalytic activity of (1-x)$Na_{0.5}Bi_{0.5}TiO_3$-x$K_{0.5}Bi_{0.5}TiO_3$ lead-free ceramics

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The lead-free ferroelectric ceramics with the formula of (1-x)$Na_{0.5}Bi_{0.5}TiO_3$-x$K_{0.5}Bi_{0.5}TiO_3$ (x = 0.00, 0.12, 0.16, 0.17, 0.18, 0.19, 0.20 and 0.30) were synthesized by conventional solid-state method. The binary system has been designed based on the phase diagram. The XRD patterns recorded at room temperature proved the phase formation of the samples. Using Rietveld refinement method which allow us to verify the morphotropic phase boundary (MPB) at x=0.12-0.18. The limits of rhombohedral and tetragonal solid solutions were successfully formed, as well as the evolution of their lattice parameters as a function of composition and temperatures were revealed. From the Scanning Electron Microscopy (SEM) analysis, have revealed uniform distribution of grains and change in grain size with the increase in $K_{0.5}Bi_{0.5}TiO_3$ concentration. Presence of functional groups has been determined by Raman Spectroscopy at room-temperature. Electrical properties of ceramics are systematically modified by the $K_{0.5}Bi_{0.5}TiO_3$ content. Electromechanical coupling factor kp = 0.291 are ameliorated at x = 0.12. The photocatalytic activity for the decolorization of methylene blue under visible light irradiation of NBT powder was evaluated. In consequence, it can be considered as a potential system in photocatalytic devices.

Keywords: (1-x)($Na_{0.5}Bi_{0.5}$)TiO_3-x($K_{0.5}Bi_{0.5}$)TiO_3; dielectric constant; Reitveld refinement ; dielectric measurements; photocatalytic activity.

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