EFFECT OF GAMMA IRRADATON ON THE SYSTEM $Ba_{1,65}Sr_{3,35}Nb_{10}O_{30}$- Ba_4Na_2 $Nb_{10}O_{30}$ SOLID SOLUTIONS WITH TTB STRUCTURE

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The effect of gamma irradiation on the structure and properties of ferro-, piezo- and pyroelectric materials are interest for extending their application fields in new active electrical elements.Gamma irradiation of perovskite (ABO_3) ceramic materials, such as barium titanate leads to the formation of stable defects, e.g., atomic displacements, or increases their lattice parameters.

The objective of this work was to study the effect of gamma irradiation on the structure and ferroelectric properties of (1-x) $Ba_{1,65}Sr_{3,35}Nb_{10}O_{30}$(BSN) - x Ba_4Na_2 $Nb_{10}O_{30}$ (BNN) solid solutions,which are known to have the tetragonal tungsten bronze (TTB) structure. The high-density speciments were prepared by solid state reactions method and hot-pressing technique. The quality of the ceramics have been evaluated by the density (95-99% to theoretical) and by the microstructure size of the grain is 4-15μm.

The lattice parameters and symmetry were determined by powder X-ray diffraction (DRON-3.0 diffractometer, Ni-filtered CuK_α-radiation).

The samples were irradiated in a ^{60}Co gamma sourse (RRhM-γ-30 or K-25 unit) at a gamma dose rate of $2,3\times10^4$Gy/h. The dose was evaluated by the ferriferons sulfate method. After irradiation, the samples were stored for 45 day (to rule out posteffects) and then poled with an electric field of 35 kV/cm at 400 K for 25 min.

There are the compositon and temperature dependences dielectric permeability (ε) and dielectric loss (tanδ) before and after gamma irradiation: 5×10^5Gy; 10×10^5Gy; 10×10^6Gy of all compositions of the solid solutions BSN-BNN.

With increasing gamma dose ε decreases monotonically. The lowest tanδ is observed at a gamma dose D=$(8\text{-}10)\times10^5$Gy. At higher doses, tanδ increases; the curve of composition dependencies of the Curie temperatures T_c after gamma irradiation of 10×10^6Gy is falling down. Similar results were reported for $K_2Sr_4Nb_{10}0_{30}$-$K_6Li_4Nb_{10}O_{30}$, and were interpreted as due to the increase in radiation-induced conductivity and accumulation of radiation-induced defects[1].

Reference:

1. Mehdiyeva R.Z. Effect of Gamma Irradiation on the Piezoelectric Properties of $K_2Sr_4Nb_{10}0_{30}$-$K_6Li_4Nb_{10}O_{30}$ Solid Solutions., Neorgan.Mater., 2002,V.38, N.8, pp.990-992.