[MS34-P02] Structural investigations of initial and fatigued Bi1/2Na1/2TiO3-xBaTiO3 piezoceramics[a]

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For the last decades, lead-based piezoceramics have been the material of choice for high-performance actuator, sensor and transducer applications. Due to detrimental effect of lead on the environment, it has to be replaced by lead-free nonhazardous materials in the near future. Among the various lead-free systems, the $Bi_{1/2}Na_{1/2}TiO_{3x}BaTiO_3$ system is an interesting candidate for structural investigation. In the present study, lead-free piezoelectric ceramics $Bi_{1/2}Na_{1/2}TiO_{3-x}BaTiO_3$ with x = 0.06 and 0.07 were prepared by a solid state sintering method. Preliminary investigations revealed a strong degradation of macroscopic electromechanical properties within the first 100 cycles [1]. Therefore, the following structural investigation was focused on a comparative study comprising X-ray, neutron and electron diffraction of freshly prepared and cycled specimen. Transmission electron microscopy (TEM) [2] and neutron diffraction of the initial specimens revealed the presence of superstructure reflections of the type •••{ooe} and •••{ooo}, where o and e denotes odd and even Miller indices, respectively. Findings can be assigned to a coexistence of a rhombohedral and a tetragonal phase with space group R3c and P4bm. *In situ* electric field X-ray diffraction revealed a strong, distinct response upon application of an external electric field of 4 kV/mm. Moreover *in situ* and *ex situ* fatigued specimens were investigated.

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