Observation of Room Temperature Ferroelectricity in $LiNbO_3$, $KNbO_3$ and $Na_{0.9}Li_{0.1}NbO_3$ Ceramics Synthesized by Conventional Solid State Reaction

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$Pb(Ti, Zr)O_3$ (PZT) was the most popular piezoelectric material up to 2003. Nevertheless, this material was restricted in the European Union because its lead content. After that, the discovery of promising piezoelectric properties in perovskite-type solid solutions of $(K, Na)(Nb, Ta)O_3$ enabled the development of technologically important lead-free piezoelectric materials and stimulated renewed scientific interest in other member of these solutions, particularly niobates. In this spirit, polycrystalline samples of $LiNbO_3$, $Na_{1-X}Li_XNbO_3$ and $KNbO_3$ compounds were successfully synthesized by standard solid-state reaction and their structural, electrical and ferroelectrical properties carefully studied. Concretely, the crystallinity of the samples was studied by means of X-ray diffraction technique. The X-ray diffraction patterns were analyzed using the Rietveld refinement method in order to verify the phase purity of the obtained compounds. In turn, electrical transport measurements showed values of the electrical resistance as high as 10^9 Ω at room temperature. Such resistance values are desired for technological applications such as electric power storage. The dielectric properties of the samples were further studied by complex impedance spectroscopy in the frequency range 5 mHz to 200 kHz. A strong dependence of the real and imaginary part of the impedance on the frequency was clearly observed. Finally, the ferroelectric characterization of the samples was carried out by means of polarization versus electrical field measurements at room temperature. Well-defined ferroelectric hysteresis, with saturation values as high as 200 $\mu C/m^2$ and capacitances of about 30 pF, were obtained for the analyzed compounds.