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Offset polarization in BNdT thin films for the application of RAM devices

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The current surge of interest in multiferroic materials showing magneto-electric coupling due to the presence of both magnetic and ferroelectric ordering is fuelled by both the potential technological applications and the underlying new physics [1-3]. The magneto-electric coupling (ME) provides an additional degree of freedom in the designing of actuators, sensors, and data storage devices [3]. From the fundamental physics point of view, the coexistence of ferroelectric and magnetic order is contra-indicated [1], as the former requires empty 'd' orbitals for the off-centre displacement of cations responsible for ferroelectricity [4] while the latter results from partially filled d orbitals. The coexistence of such mutually exclusive phenomena in some compounds has been attributed to new mechanisms of ferroelectricity, such as lone pair stereochemical activity of the 'A' site cation [1-3,], loss of inversion symmetry due to spiral magnetic ordering [1-3], and change in geometrical arrangement of ions [1,2] After an introduction of the basic ideas and how the work relates to other work, providing some relevant References in short format [1, 2], present detailed descriptions of methods, device structures, and examples of specific results, whether experimental or theoretical. If absolutely necessary, these results can be supported by figures and/or tables, but only in strict compliance with space limits and preserving clarity. Multiferroic materials simultaneously present both ferroelectric and spin orders, which enable them to have potential applications in both magnetic and ferroelectric devices. So, the development of such type of material, which has magneto-electric properties in same phase at room temperature, is the milestone for modern technology. These materials have potential applications in memory devices where one can write ferroelectrically and read magnetically or vice versa. We report the multiferroic properties of polycrystalline homogeneous Bi4-xNdxTi3O12 (BNdT) ferroelectric thin films sandwiched in Pt electrodes by chemical solution deposition. Dense and uniform BNdT films were achieved by rapid thermal annealing the spin-on films at 700 °C for 3 min in oxygen environment. All the samples exhibited well-saturated hysteresis loops with remenant polarization (2Pr) increasing from 36.22 μC/cm2 (x = 0.0) to 109.86 μC/cm2 (x = 0.1), respectively, while the coercive field (2EC) = 64.6 kV/cm remained unchanged for all compositions at room temperature after exposing the films using Swift heavy ion irradiation. Polarization offset was observed in the compositionally graded ferroelectric thin films as a function of temperature. Polarization offset was notable after 100 °C and increased with increasing temperature which may be related to thermionic charge injection, which is asymmetric to top and bottom electrodes.

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Sliding wear behavior of A356/Al_2O_3 metal matrix nano-composites under both dry and oil lubricating conditions

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In the present investigation the wear behavior of A356/Al_2O_3 metal matrix nano-composites (MMNCs) were investigated at both room and elevated temperatures under dry sliding conditions. Moreover, the wear behavior of the A356/Al2O3 MMNCs was investigated at room temperature under oil lubricating conditions. The results revealed that the A356/Al2O3 MMNCs exhibited lower wear rates at both room and elevated temperatures when compared with the A356 monolithic alloy. Increasing both the volume fraction and/or reducing the Al2O3 nanoparticles size reduces the wear rates of the A356/Al2O3 MMNCs. The composites exhibited transition temperature between 150 and 200oC, while the unreinforced alloy exhibited a transition temperature between 100 and 150oC. The wear rates of the nano-composites under oil lubricating conditions were much lower than under dry sliding conditions at room temperature. Increasing the volume fraction reduces the wear rate of the nano-composites. Increasing the sliding speed increases slightly the wear rate of the nano-composites under oil lubricating conditions.

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