{001} Oriented Piezoelectric Films Prepared by Chemical Solution Deposition on Ni Foils

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Abstract: Flexible metal foil substrates are useful in some microelectromechanical systems applications including wearable piezoelectric sensors or energy harvesters based on Pb(Zr,Ti)O-3 (PZT) thin films. Full utilization of the potential of piezoelectrics on metal foils requires control of the film crystallographic texture. In this study, {001} oriented PZT thin films were grown by chemical solution deposition (CSD) on Ni foil and Si substrates. Ni foils were passivated using HfO2 grown by atomic layer deposition in order to suppress substrate oxidation during subsequent thermal treatment. To obtain the desired orientation of PZT film, strongly (100) oriented LaNiO3 films were integrated by CSD on the HfO2 coated substrates. A high level of {001} LaNiO3 and PZT film orientation were confirmed by X-ray diffraction patterns. Before poling, the low field dielectric permittivity and loss tangents of (001) oriented PZT films on Ni are near 780 and 0.04 at 1 kHz; the permittivity drops significantly on poling due to in-plane to out-of-plane domain switching. (001) oriented PZT film on Ni displayed a well-saturated hysteresis loop with a large remanent polarization similar to 36 μC/cm(2), while (100) oriented PZT on Si showed slanted P-E hysteresis loops with much lower remanent polarizations. The vertical bar e(31),(f)vertical bar piezoelectric coefficient was around 10.6 C/m(2) for hot-poled (001) oriented PZT film on Ni. (C) 2014 AIP Publishing LLC.