{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 HfO_2 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 $LaNiO_3$ films were integrated by CSD on the HfO_2 coated substrates. A high level of {001} $LaNiO_3$ 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 mu C/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.