

Piezoelectric/Electrostrictive Multimaterial PMN-PT Monomorph Actuators

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Abstract

Fused deposition of multi-materials (FDMM), a CAD-based layered manufacturing technique, was utilized to fabricate monolithic piezoelectric/electrostrictive multi-material monomorphs. Monolithic multi-material samples, comprised of piezoelectric $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3\text{-PbTiO}_3$, 0.65PMN-0.35PT, and electrostrictive 0.9PMN-0.1PT, have been successfully co-fired. Multi-material monomorphs, that are isometric with the co-fired ones, have also been prepared by gluing individual layers, and were used in a comparative study. The dielectric permittivity, displacement, and polarization hysteresis were investigated. The permittivity of the multimaterial sample followed the dielectric mixing laws, showing a dielectric constant of 5,800 at room temperature. The P-E loop of the multimaterial sample exhibited a saturation polarization similar to that of the single material electrostrictive 0.9PMN-0.1PT. Hysteresis was shown to be lower for the monolithic monomorph as compared to the glued monomorph.

Keywords: Piezoelectric, Electrostrictive, Monomorph, Actuator