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Giant Magnetoelectric Energy Conversion Utilizing Inter-Ferroelectric Phase Transformations in Ferroics PETER FINKEL, MARGO STARUCH, US Naval Research Laboratory — Phase transition-based electromechanical transduction permits achieving a non-resonant broadband mechanical energy conversion see (Finkel et al Actuators, 5 [1] 2. (2015)) , the idea is based on generation high energy density per cycle , at least 100x of magnitude larger than linear piezoelectric type generators in stress biased [011]cut relaxor ferroelectric Pb(In1/2Nb1/2)O3-Pb(Mg1/3Nb2/3)O3-PbTiO3 (PIN-PMN-PT) single crystal can generate reversible strain >0.35% at remarkably low fields (0.1 MV/m) for tens of millions of cycles. Recently we demonstrated that large strain and polarization rotation can be generated for over 40 x 10^6cycles with little fatigue by realization of reversible ferroelectric-ferroelectric phase transition in [011] cut PIN-PMN-PT relaxor ferroelectric single crystal while sweeping through the transition with a low applied electric field <0.18 MV/m under mechanical stress. This methodology was extended in the present work to propose magnetoelectric (ME) composite hybrid system comprised of highly magnetostrictive alloymFe81.4Ga18.6 (Galfenol), and lead indium niobate–lead magnesium niobate–lead titanate (PIN-PMN-PT) domain engineered relaxor ferroelectric single crystal. A small time-varying magnetic field applied to this system causes the magnetostrictive element to expand, and the resulting stress forces the phase change in the relaxor ferroelectric single crystal. ME coupling coefficient was fond to achieve 80 V/cm Oe near the FR-FO phase transition that is at least 100X of magnitude higher than any currently reported values.

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