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Coupled improvement between thermoelectric and piezoelectric materials DAVID MONTGOMERY, COREY HEWITT, CHAOCHAO DUN, DAVID CARROLL, Wake Forest University — A novel coupling effect in a thermoelectric and piezoelectric meta-structure is discussed. Thermo-piezoelectric generators (TPEGs) exhibit a synergistic effect that amplifies output voltage, and has been observed to increase piezoelectric voltages over 500% of initial values a time dependent thermoelectric/pyroelectric effect. The resulting improvement in voltage has been observed in carbon nanotubes as well as inorganics such as two-dimensional Bismuth Selenide platelets and Telluride nanorods thin-film thermoelectrics. TPEGs are built by integrating insulating layers of polyvinylidene fluoride (PVDF) piezoelectric films between flexible thin film p-type and n-type thermoelectrics. The physical phenomena arising in the interaction between thermoelectric and piezoelectrics is discussed and a model is presented to quantify the expected coupling voltage as a function of stress, thermal gradient, and different thermoelectric materials. TPEG are ideal to capture waste heat and vibrational energy while creating larger voltages and minimizing space when compared with similar thermoelectric or piezoelectric generators.

David Montgomery
Wake Forest University

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