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High Frequency Supercapacitors for Piezo-based Energy Harvesting MATTHEW ERVIN, US Army Research Laboratory, CARLOS PEREIRA, Armament Research Development Engineering Center, JOHN MILLER, JME Inc., RONALD OUTLAW, The College of William and Mary, JAY RASTEGAR, RICHARD MURRAY, Omnitech Partners LLC — Energy harvesting is being investigated as an alternative to batteries for powering munition guidance and fuzing functions during flight. A piezoelectric system that generates energy from the oscillation of a mass on a spring (set in motion by the launch acceleration) is being developed. Original designs stored this energy in an electrolytic capacitor for use during flight. Here we replace the electrolytic capacitor with a smaller, lighter, and potentially more reliable electrochemical double layer capacitor (aka, supercapacitor). The potential problems with using supercapacitors in this application are that the piezoelectric output greatly exceeds the supercapacitor electrolyte breakdown voltage, and the frequency greatly exceeds the operating frequency of commercial supercapacitors. Here we have investigated the use of ultrafast vertically oriented graphene array-based supercapacitors for storing the energy in this application. We find that the electrolyte breakdown is not a serious limitation as it is either kinetically limited by the relatively high frequency of the piezoelectric output, or it is overcome by the self-healing nature of supercapacitors. We also find that these supercapacitors have sufficient dynamic response to efficiently store the generated energy.

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