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Energy Harvesting Potential of Bendable Concrete using Polymer Based Piezoelectric Generator

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Abstract

Piezoelectric materials have gained a lot of attention in the last few decades as they introduce a renewable and sustainable approach for energy harvesting from vibrations or mechanical deformation in our environment. Among piezoelectric materials, polyvinylidene fluoride (PVDF) is one of the most commonly used piezoelectric polymers due to its high flexibility and piezoelectric performances. In this work, engineered cementitious composites (ECC) incorporating flexible PVDF based piezo polymer has been investigated as an innovative energy harvesting system to scavenge energy from mechanical deflection of ECC. Synchronous flexural test and voltage data recordings were employed to evaluate the voltage capture efficiency of two different lengths of PVDF (41mm and 73mm). The various loading rates of four-point bending tests were conducted to assess the energy harvesting performance. The results show that the voltage/power generated by the system is more efficient for longer PVDF samples as compared to the shorter ones when subjected to the four-point flexural test. High loading rates were found to be favorable for energy harvesting. The experimental results lay a solid foundation for potential energy harvesting application of the new cementitious composite system for development of multi-function building materials.

Keywords*: Piezoelectric; Energy harvesting; PVDF, ECC*