Impact of Mechanical Design on Piezoelectric Energy Collection

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This experiment evaluated various mechanical configurations to maximize the energy harvesting potential of ceramic piezoelectrical discs. This project focused on configurations suitable for retrofitting beneath existing infrastructure, such as pedestrian floor mats or sidewalk overlays, to capture energy without drastic structural changes. Additionally, it set material cost-effectiveness as a primary design constraint to address the economic barriers of current piezoelectric technology. Six designs were compared, including a single disc control, three vibration plank designs, a parallel array design, and a spring-amplified design. Pressure was applied consistently and manually at a fixed frequency of once per second. The discs were routed in parallel to a capacitor, and voltage accumulation was measured using a digital multimeter and recorded in 30-second increments over a total duration of 150 seconds, with five trials per design. Results indicated that the parallel array design yielded the greatest voltage accumulation in the capacitor during each 30s interval. However, the vibrational plank designs (particularly wood and PLA designs) exhibited higher practical viability for real-world integration, as their low-profile configuration could enable easier implementation while also balancing electrical output with structural durability.

Awards Won: