Fabrication and Characterization of \( d_{33} \) Mode 
\((1-x)\text{Pb(Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3-x\text{PbTiO}_3\) (PMN-PT) 
Energy Harvester

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In this manuscript, a \( d_{33} \) mode piezoelectric micro-electromechanical systems (MEMS) energy harvester integrated with silicon proof mass, which is made of composite cantilever beams from a silicon layer and a single crystal PMN-PT thick film, is proposed. The silicon mass is fabricated by the deep-reactive ion etching (DRIE) process to reduce the resonant frequency for a matching ambient source. A PMN-PT film of 15 µm thickness is realized by the hybrid process of wafer bonding and grinding. The experimental results show that this fabricated prototype can generate a maximum output voltage of 1.18 V_{P-P} and corresponding power of 0.139 µW at the resonant frequency of 200 Hz and vibration acceleration of 2 g.

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