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All-thin-film PZT/FeGa Multiferroic Cantilevers and Their Applications in Switching Devices and Parametric Amplification YI WANG, TIBERIU-DAN ONUTA, CHRIS LONG, University of Maryland, College Park, SAMUEL LOFLAND, Rowan University, ICHIRO TAKEUCHI, University of Maryland, College Park — We are investigating the characteristics of microfabricated PZT/FeGa multiferroic cantilevers. The cantilevers can be driven by AC or DC magnetic and electric field, and the device response can be read off as a piezo-induced voltage. We can use the multiple input parameters to operate the devices in a variety of manners for different applications. They include electromagnetic energy harvesting, pulse triggered nonlinear memory devices, and parametrically amplified ME sensors. Due to the competition of anisotropy and Zeeman energies, the mechanical resonant frequency of the cantilevers was found to follow a hysteresis behavior with DC bias magnetic field applied in the cantilever easy axis. We can also control and tune the occurrence of nonlinear bifurcation in the frequency spectrum. The resulting hysteresis in the frequency spectrum can be used to make switching devices, where the input can be DC electric and magnetic fields, as well as pulses of AC fields. We have also demonstrated parametric pumping of the response from an AC magnetic field using frequency-doubled AC electric field. The enhanced equivalent ME coefficient is as high as 10 million V/(cm*Oe), when the pumping voltage is very close to a threshold voltage. The quality factor also increases from 2000 to 80000 with pumping.

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