Controlling Magnetization using Patterned Electrodes on a Piezoelectric Film

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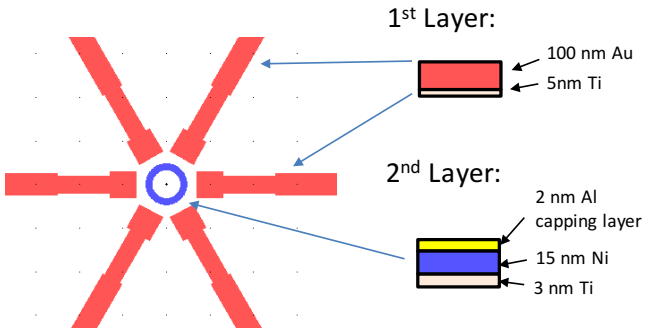
Controlling magnetostrictive heterostructures on thin film ferroelectrics deposited on Si represents a challenge because the magnetostrictive material responds to the in-plane components of strain yet the piezoelectric film is clamped by the substrate. The clamping effect can be overcome by taking advantage of the stress concentration around the edges of the electrodes. As the electrodes are reduced in size to the same length scale as the film thickness, large in-plane strain components can be generated. By placing magnetostrictive features in these regions, the magnetization can be controlled through the application of voltage. This presentation will step through the early work of demonstrating the switching of easy and hard orientations on 0.5 mm thick PZT to the realization of the same effect in a one-micron ring on thin film PZT on a Si substrate. The device architecture is shown.



Although the approach was clearly demonstrated, several challenges were also discovered that have not yet been resolved and are the subject of ongoing research. These are associated with the pinning of the magnetic domains by surface features on the piezoelectric film.