Zeynep Çelik-Butler
Professor
Electrical Engineering Department
University of Texas at Arlington
Arlington, TX 76019
zbutler@uta.edu
http://www-ee.uta.edu/zbutler/

Flexible, Bendable, and Squishy MEMS Sensors

MEMS devices in flexible substrates have applications where the ability to conform to a non-planar surface or the savings in size and weight are advantageous. Towards this end, MEMS sensors in flexible substrates have been developed for medical and structural health monitoring applications and also in defense. Novel emerging sensor technologies and applications require low-cost, adaptable, and scalable, wafer and device level packaging. We present several designs for device-level self-packaged thermal detectors, pressure sensors, MEMS resonators and accelerometers. Both rigid Si substrates and flexible polyimide substrates are discussed. Device level packaging is necessary for optimum sensor performance without sacrificing flexibility. This could facilitate integration of multi-functional sensory arrays on single flexible substrates, so called 'smart-skin' for simultaneous and real-time sensing of various mechanical, biological and chemical elements. Our group has reported the design, modeling and simulation of micromachined integrated pressure–thermal sensors on flexible polyimide substrates. One challenge in fabricating sensors on flexible polyimide substrates is the stringent limits they impose on the processing temperatures. We will discuss the novel methods used to circumvent these limitations.