Integrated Electronics for Control of Large-area Piezoelectric Arrays for Adjustable Optics

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Direct integration of electronics on piezoelectrics is attractive for large array transducers and adjustable optics systems; it allows for the possibility of reconfigurability as well as active surfaces with a greatly reduced number of electrical connections. In this work, lead zirconate titanate (PZT) piezoelectric films were co-processed with ZnO thin film transistors to explore the possibility of direct integration. The sputter deposited PZT on glass had good electrical properties on large area (cm(2)) electrodes, with a dielectric constant of >1200 with a loss of approximately 2% and an average remanent polarization of greater than >23 mu C/cm(2). Fabrication of arrays of thin film transistors (TFTs) processed directly on top of PZT pixels for use in an adaptive optics system was demonstrated. Photoreactive benzocyclobutene (BCB) electrically isolated the ZnO TFTs, deposited using plasma enhanced atomic layer deposition, from the electrodes on the piezoelectric cell. Flex cables were bonded to the wafer using anisotropic conductive film (ACF) to connect the gates (row control) and the drains (column control) in the TFT array to a control box. It was found that when actuating the PZT cells through the TFT array with 5-10 V, the glass mirror experienced approximately 700-1000 nm of deflection, adequate for figure control in future X-ray mirrors.

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