



AlMn Transition Edge Sensors for Advanced ACTPol

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The next generation of Cosmic Microwave Background experiments (CMB Stage-4) will require large numbers of cryogenic, low-noise detectors that are uniform over a large monolithic array, and have tunable parameters for different readout schemes. The Advanced Atacama Cosmology Telescope Polarimeter (Advanced ACTPol) will use an array of multichroic polarization sensitive AlMn transition edge sensor (TES) bolometers that couple to time-division multiplexing and microwave superconducting quantum interference device (SQUID) multiplexing. Aluminum doped with a low concentration of manganese can be deposited to a bulk film thickness for a more reliable superconducting critical temperature uniformity compared to thin bilayers. To build the TES, AlMn is deposited, over Nb wiring, to a specific thickness to set the TES normal resistance. The doping concentration of manganese coarsely defines the TES critical temperature, while a fine tuning is achieved by heating the deposited film to a specific temperature. The TES island is connected to the array substrate via four silicon nitride membranes, where their geometry defines the thermal conductance to the temperature bath. Lastly, the TES heat capacity is set by addition of PdAu electrically connected to the AlMn film. Designs and measurements will be presented to show their performance characteristics for use in Advanced ACTPol.