PZT has gained increasing interest as a NVRAM material as well as continued use in MEMS devices and actuators. By utilizing a LNO buffer layer and a novel ex-situ PVD layering method, (100) orientation of PZT films, as characterized by XRD data, was maximized. This maximization of (100) orientation is key to optimizing the pyroelectric properties of PZT thin films for applications in MEMS devices. Additionally, this new process was able to minimized the appearance of pyrochlore phases. Pyrochlore has been shown to be detrimental to pyroelectric properties as well as increasing fatigue rate in films. Ellipsometry modeling was used to obtain the film thicknesses. Fatigue tests were then performed on 1 to 5 layer PZT films (0.4 to 2 um) showing a strong correlation between thickness and unipolar fatigue. Unipolar fatigue testing is shown to be a superior method, than that of bipolar fatigue testing in thin film piezoelectrics. This is attributed to the reduced fatiguing found in unipolar fatigue testing (poling typically used in MEMS devices) as compared to bipolar fatigue which is likely to over estimate the fatigue characteristic to a device.