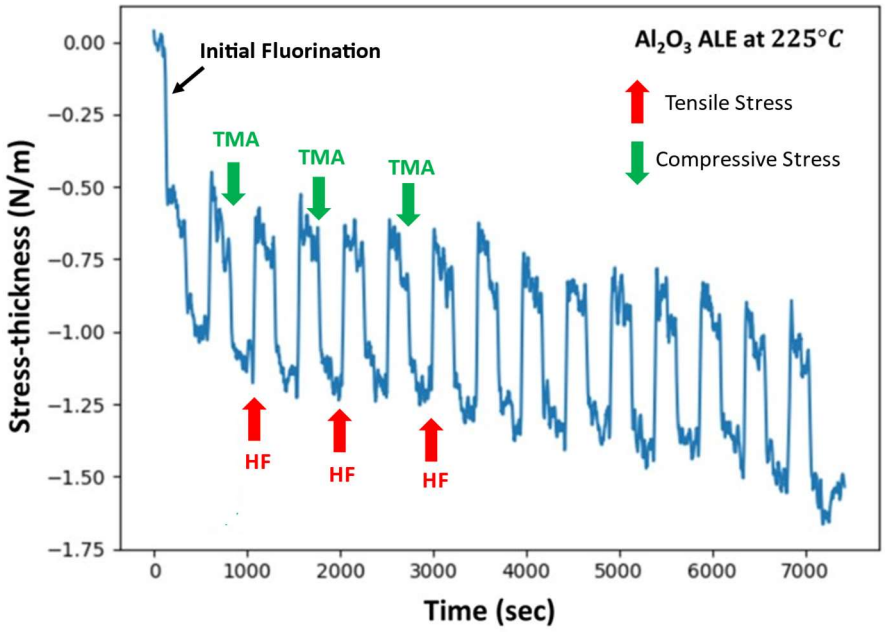

Figure 1: Al_2O_3 ALE performed at 225°C. The initial HF exposure converts the Al_2O_3 to AlF_3 and produces the initial compressive stress. The initial Al_2O_3 ALD film was under tensile stress of 400 MPa. Al_2O_3 ALE led to an apparent compressive film stress resulting from the removal of the Al_2O_3 ALD film. The TMA and HF exposures result in compressive and tensile surface stresses, respectively, that can be attributed to the addition and removal of surface methyl groups.

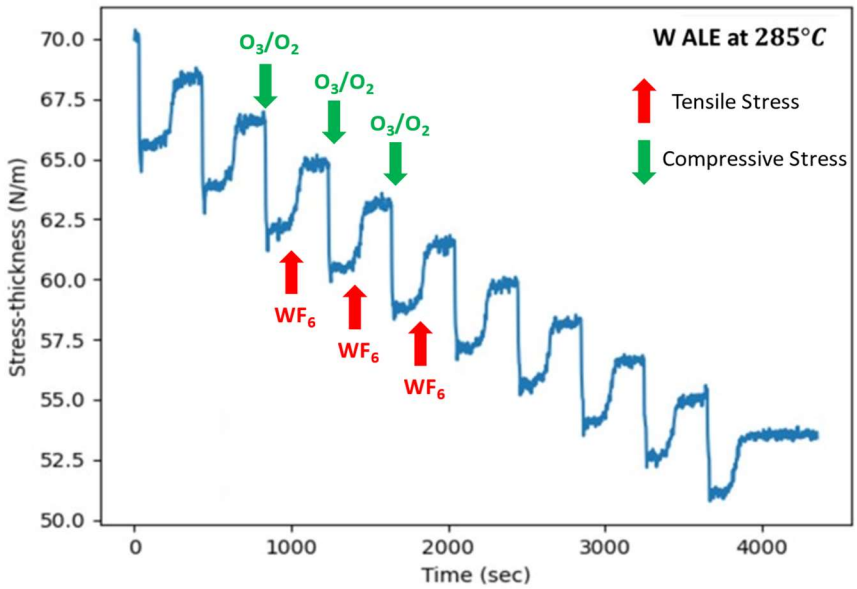

Figure 2: Tungsten ALE at 285°C. The initial W ALD film was under tensile stress of 1000 MPa. Consequently, W ALE led to an apparent compressive film stress resulting from the removal of the W ALD film. The O_3/O_2 exposures oxidize the W surface to create WO_x and a compressive stress. The following WF_6 exposures remove the WO_x and release the compressive stress.