Supplemental Information

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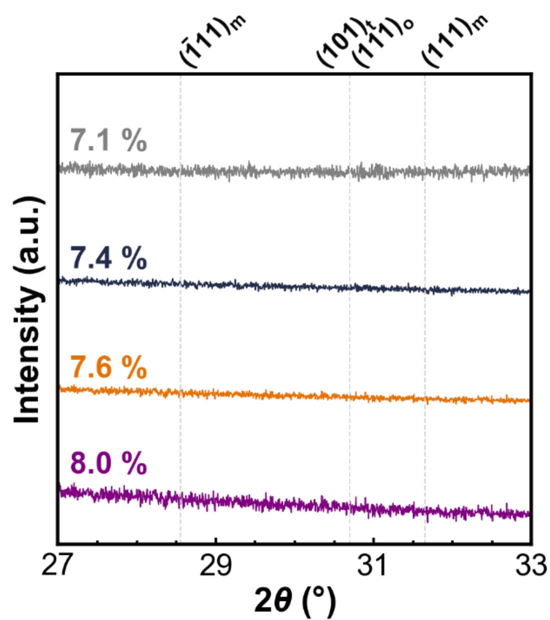

Figure S1: GIXRD patterns for as-deposited films.

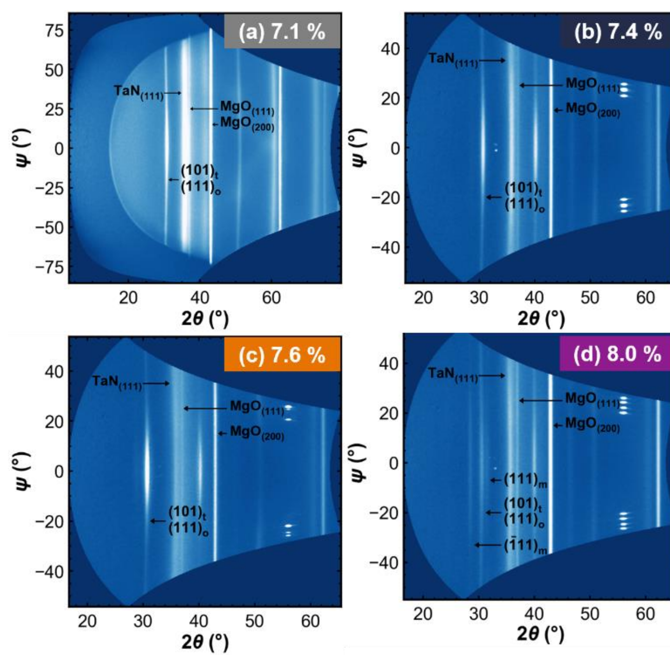

Figure S2: Area detector XRD measurements for crystallized (a) 7.1, (b) 7.4, (c) 7.6, and (d) 8.0 % films.

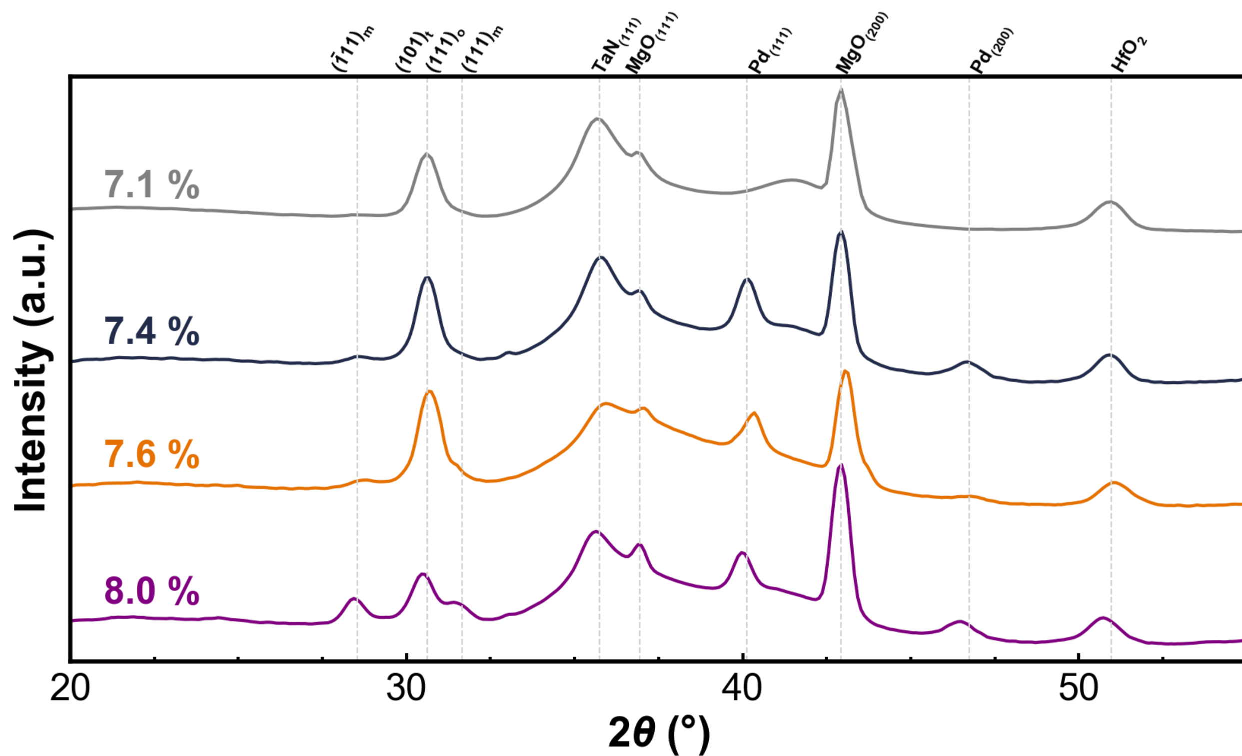

Figure S3: Integrated XRD patterns from the Bruker APEXII Duo Single Crystal X-Ray diffractometer.

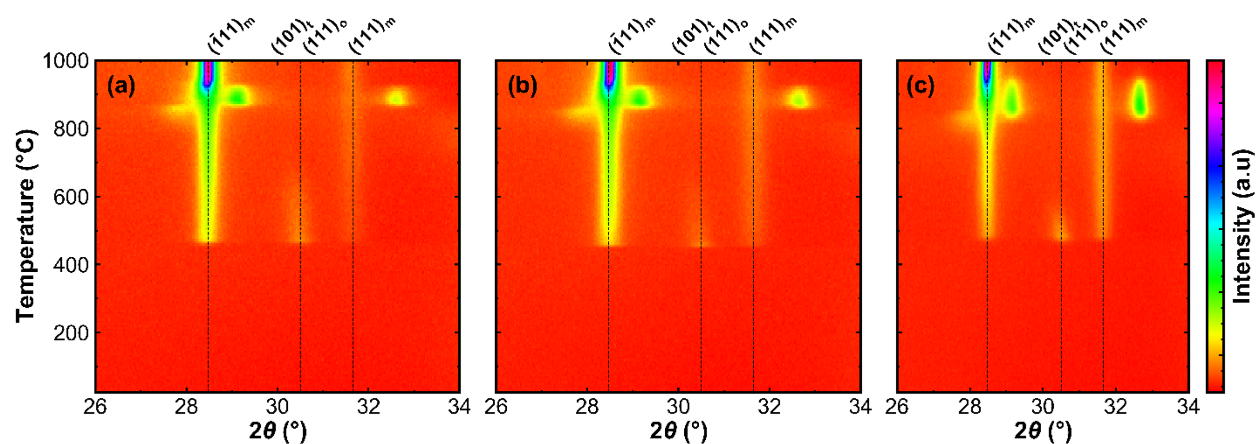

Figure S4: High temperature XRD measurements of films deposited with equivalence of (a) 7.4, (b) 7.6, and (c) 8.0 % oxygen.

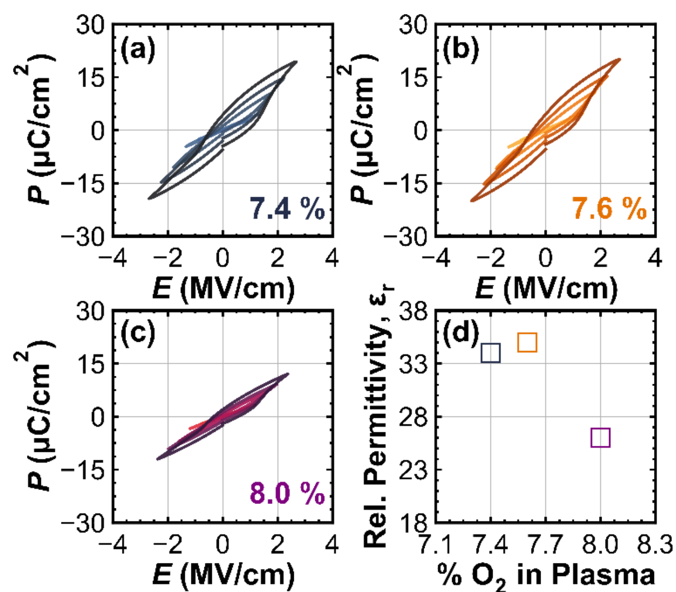

Figure S5: Nested polarization hysteresis measurements for the samples deposited with (a) 7.4 % O_2, (b) 7.6 % O_2, and (c) 8.0 % O_2 before field cycling. (d) Relative permittivity versus % O_2 in the plasma.

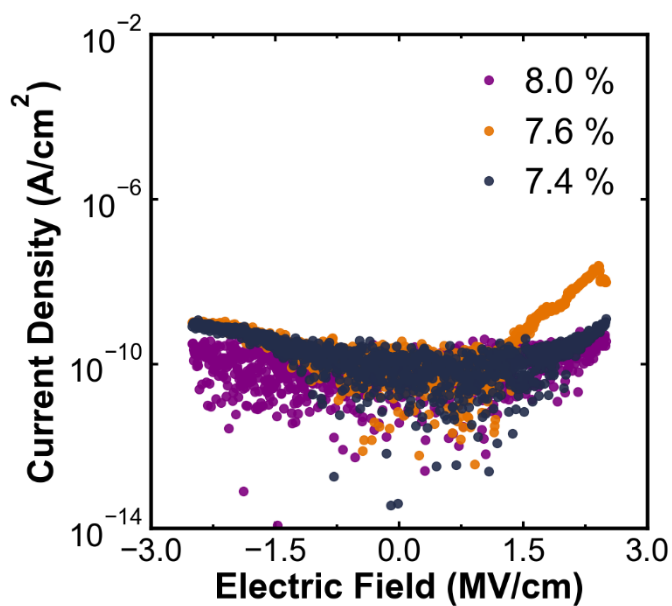

Figure S6: Leakage current density measurements for annealed films deposited with 7.4, 7.6, and 8.0 % oxygen in the sputtering atmosphere.

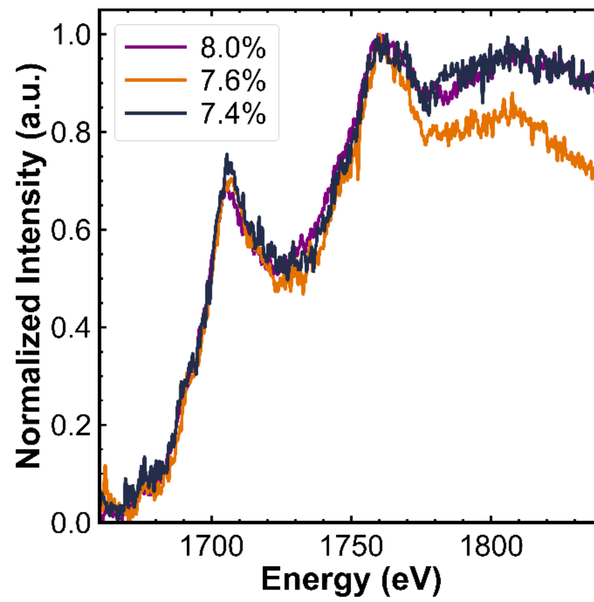

Figure S7: EELS spectra showing the Hf-*M* edge used for stoichiometry calculations of annealed films deposited with 7.4, 7.6, and 8.0 % oxygen in the sputtering atmosphere.