Supporting Information

Atomic Layer Deposition of Tin Oxide Using Tributyltin Ethoxide with Ozone

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Figure S1: Thermogravimetric analysis of tributyltin ethoxide.

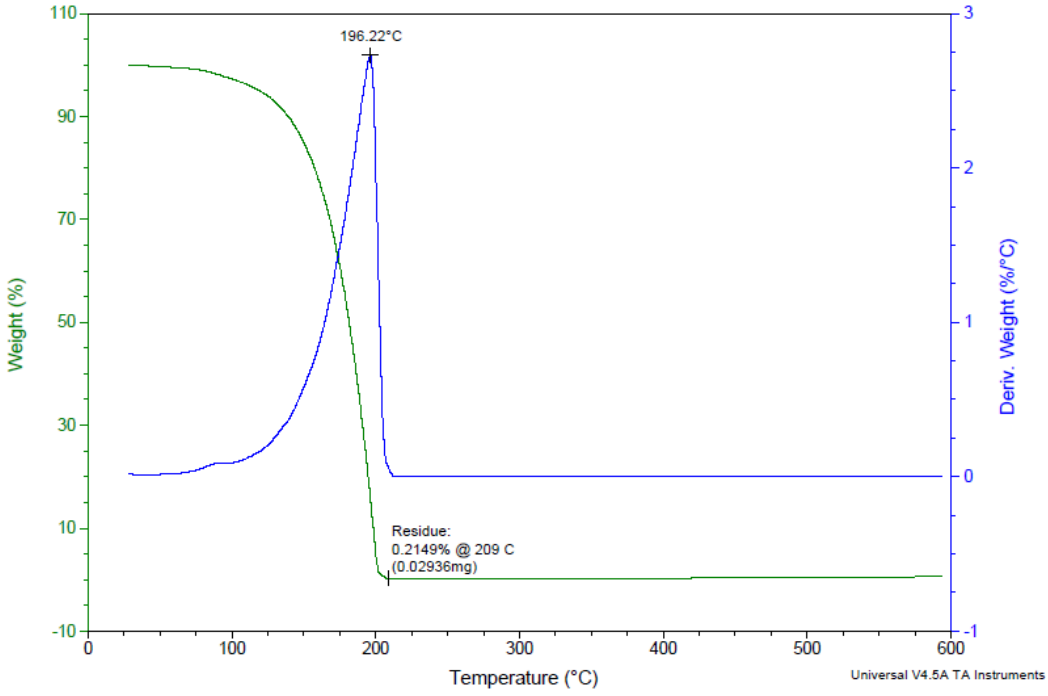

Figure S2: Differential infrared absorbance spectrum obtained by referencing the spectrum after the 400 °C pre-annealed to the initial OH-terminated SiO_2-passivated Si(111) surface.

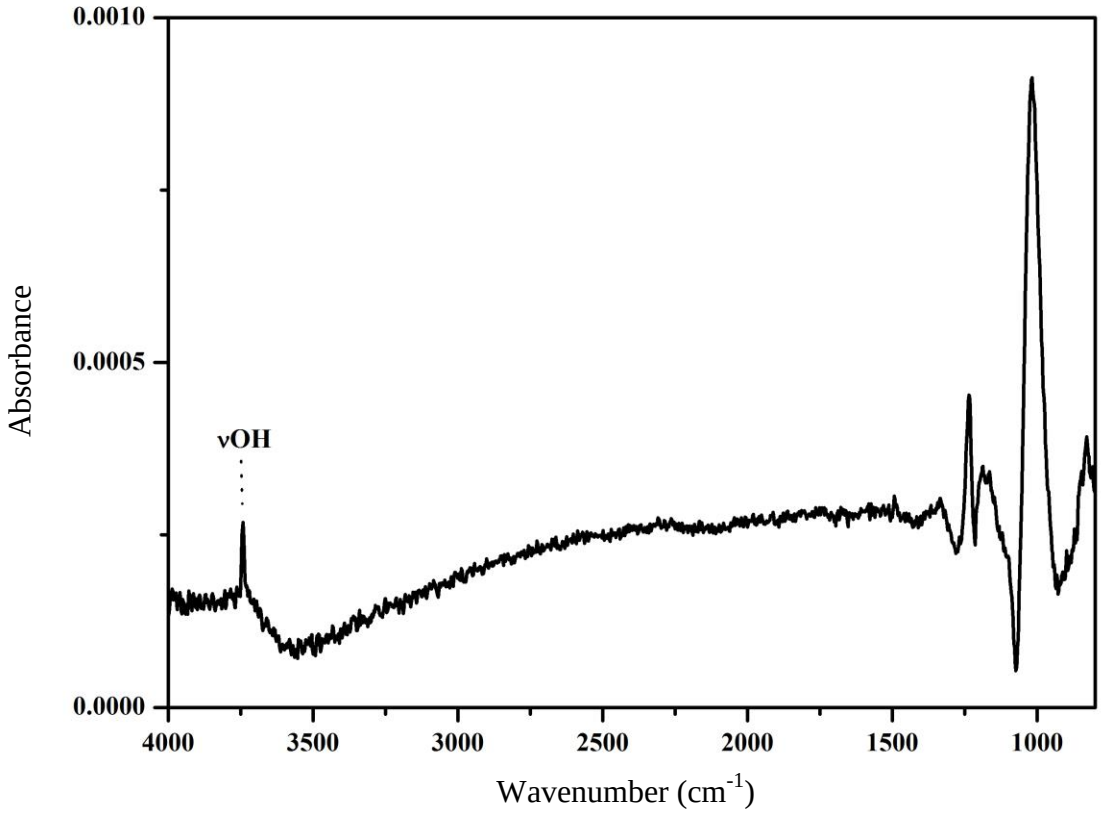

Figure S3: C-H stretching bands region of the differential infrared absorbance spectra during the 1st, 2nd and 20thALD cycles at 200 °C with tributyltin ethoxide (nth Sn) and ozone (nth O_3) (Concentration = 250 g/Nm^3 , flow = 100 sccm, with 60 s pulse with 60 s trapping), on OH-terminated SiO_2 on Si (111) referenced to each preceding treatment.

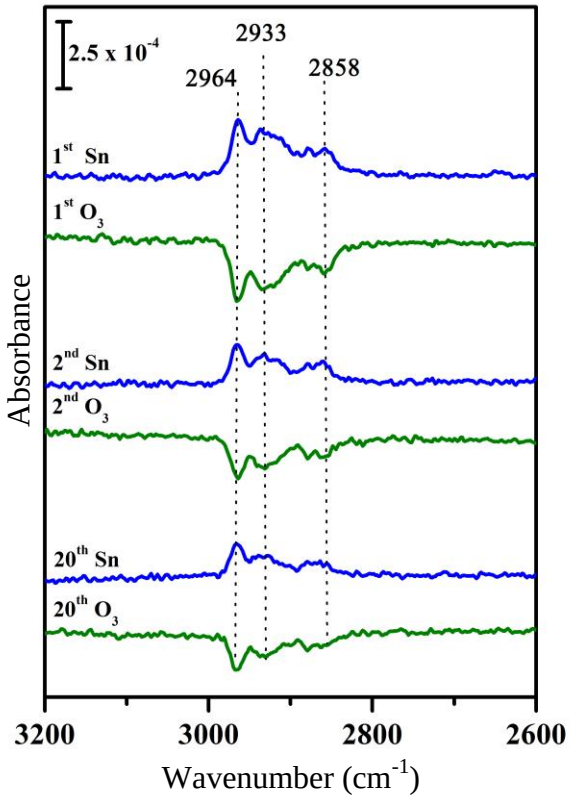

Figure S4: Differential infrared absorbance spectra during the first two ALD cycles at 300°C with tributyltin ethoxide (n^{th} Sn) and ozone (n^{th} O_3) (Concentration = 250 g/Nm^3 , flow = 100 sccm, with 60 s exposure with 60 s trapping.), on OH-terminated SiO_2 on Si (111) referenced to each preceding treatment. (C: carbonate and F: formate). The spectra in the right hand side panel were multiplied by 2 to clearly see the features.

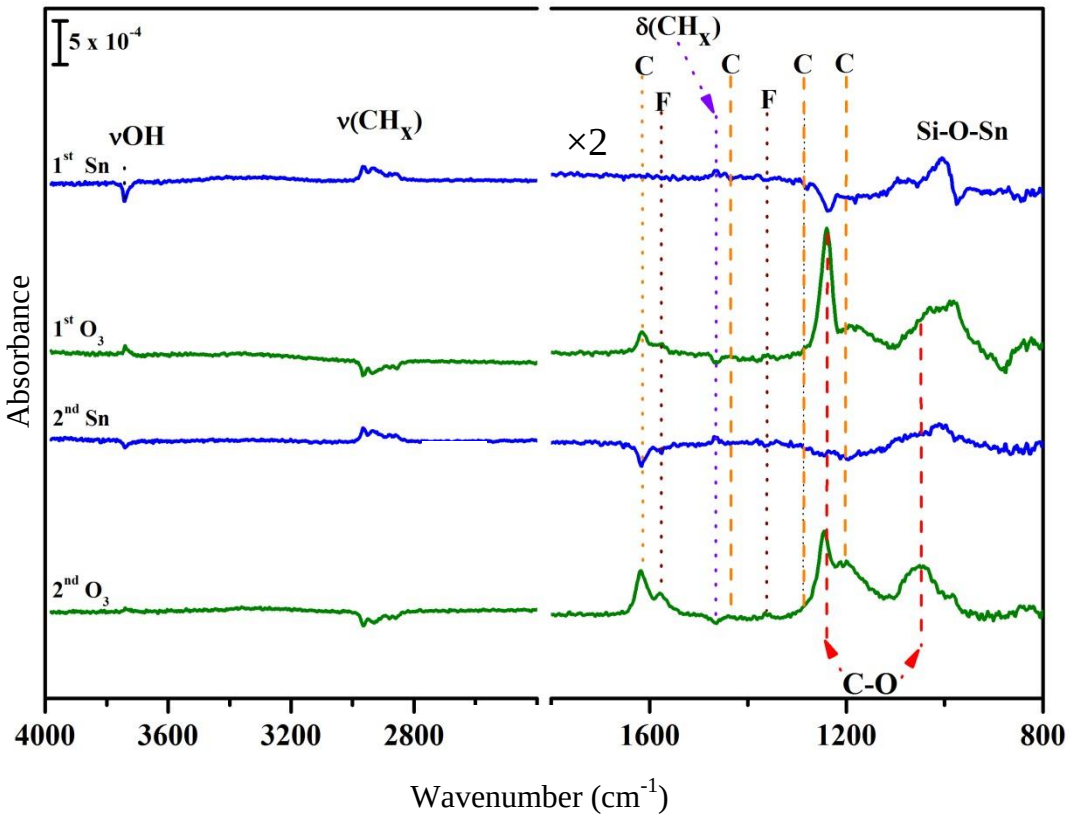

Figure S5: XPS depth profiles of the ALD grown SnO_x films at 300 °C with tributyltin ethoxide and ozone (Concentration = 250 g/Nm^3, flow = 100 sccm, with 60 s exposure with 60 s trapping) on OH-terminated SiO_2 on Si (111) (20 cycles).

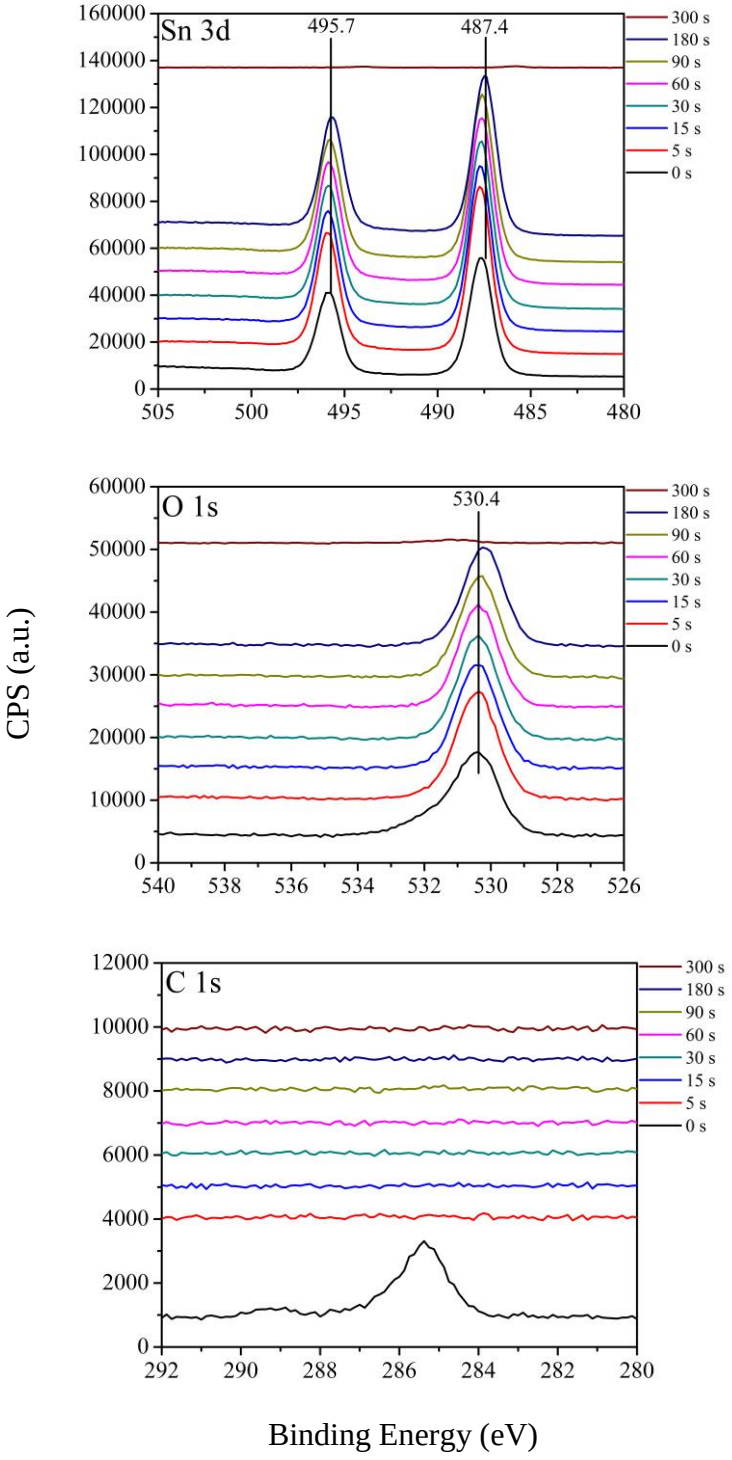

Figure S6: Precursor saturation at 225 °C and 268 °C using 2 s tributyltin ethoxide and 5 s ozone exposures using the cross flow reactor. Inlet- film grown closer to the precursor inlet to the reactor and Outlet – film grown closer to the precursor outlet of the reactor.

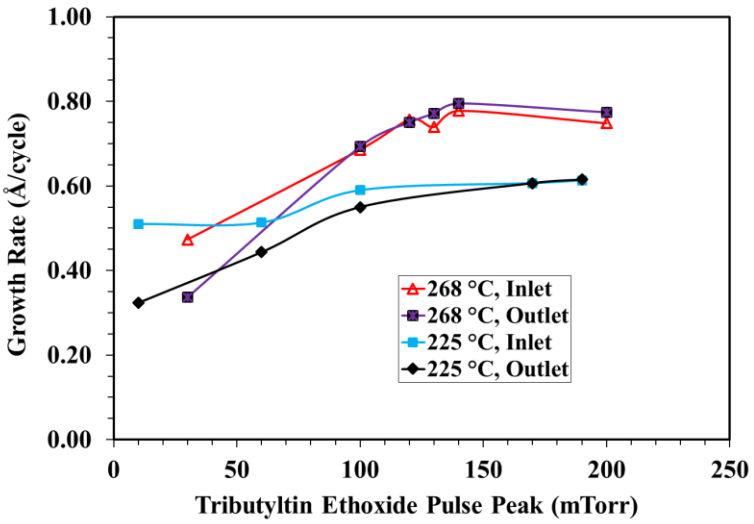

Figure S7: Electrical resistivity of SnOx films as a function of the deposition temperature from 200 °C to 300 °C using 2 s tributyltin ethoxide and 5 s ozone exposures using the cross flow reactor. Inlet - film grown closer to the precursor inlet to the reactor and Outlet - film grown closer to the precursor outlet of the reactor.

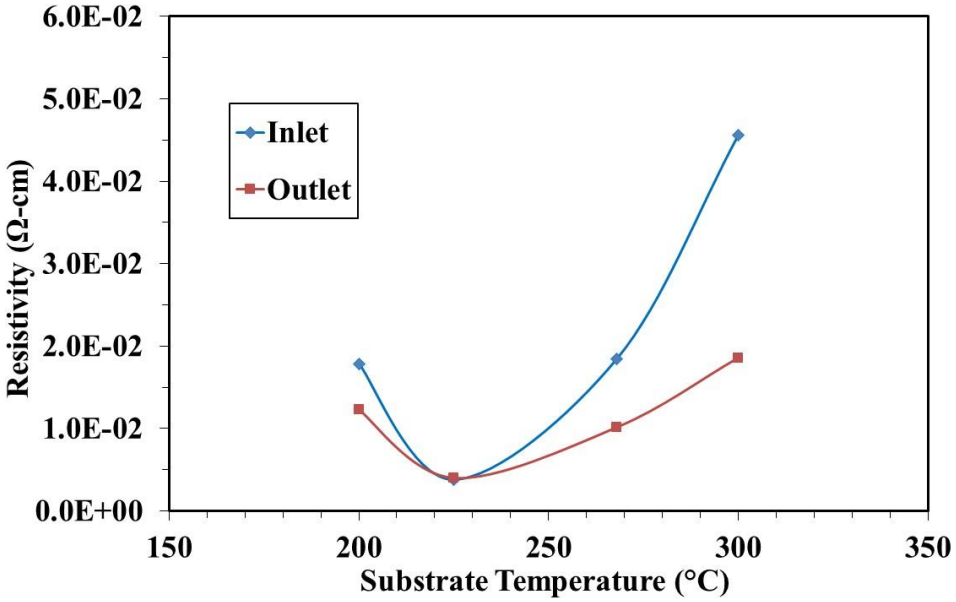

Figure S8: Electrical resistivity of SnOx films deposited at 225 °C using 2 s tributyltin ethoxide and 5 s ozone exposures as a function of SnO_x film thickness using the cross flow reactor. Inlet - film grown closer to the precursor inlet to the reactor and Outlet - film grown closer to the precursor outlet of the reactor.

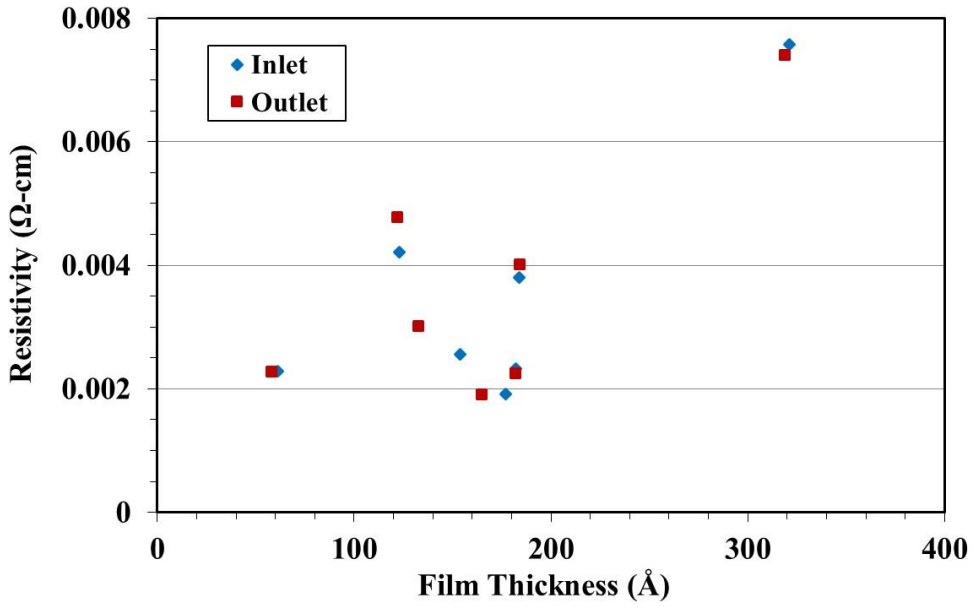

Table S1: Standard process recipe for film deposition using a cross-flow reactor.

Parameter	Value
Tributyltin ethoxide pulse	2 s
Purge time after tributyltin ethoxide pulse	5 s
Ozone pulse	5 s
Purge time after ozone pulse	10 s
Ozone concentration	200 g/m^3
Ozone flow rate	300 sccm