Abstract Title: Thermal Stability of HfO_2 by Incorporating Al_2O_3 in a MIM Capacitor by 200 mm Batch-ALD

P. Mukhopadhyay et al.

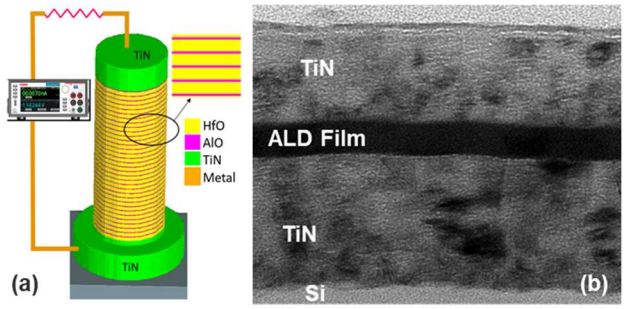

Fig S1: Cross-sectional (a) schematic drawing and (b) TEM actual image of fabricated MIM capacitor.

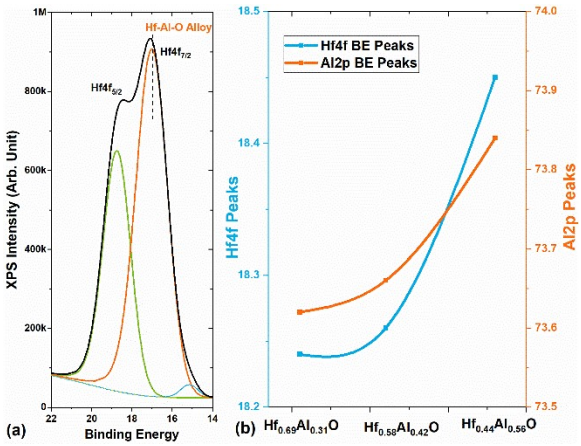

Fig S2: (a) Hf4f peaks of Hf-Al-O alloy plotted (b) variations of peaks were plotted with various Al incorporations. With more Al content in the alloy, both the peaks shift to higher binding energy.

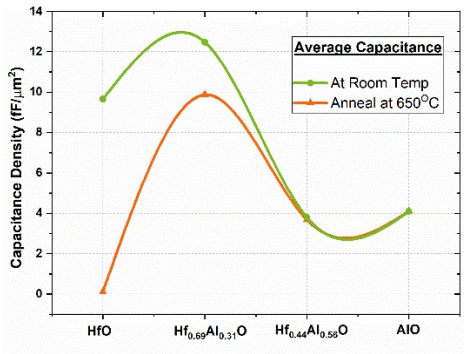

Fig 3: Capacitance density at 0 V applied bias for various Al content in hafnium aluminate. After annealing at higher temperatures HfO_2 becomes leaky while low Al content alloy holds the highest capacitance density even after slight degradation.

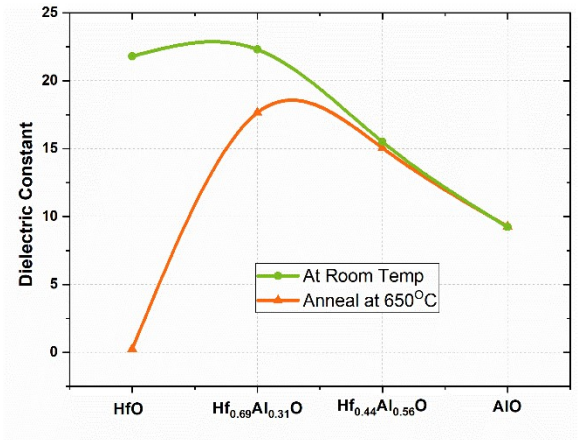

Fig 4: Dielectric constant with respect to Al content in hafnium aluminate. After annealing at higher temperatures HfO_2 becomes leaky while low Al content alloy holds the highest k-value. Here the high Al content alloy shows a 68% higher k-value than Al_2O_3 even under thermal stress

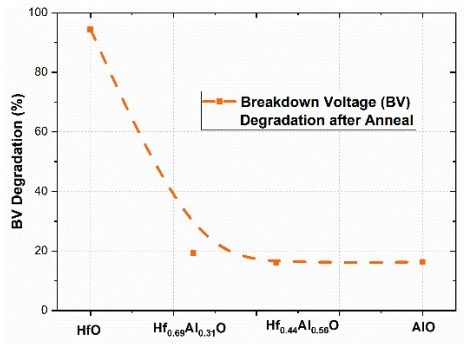

Fig 5: Breakdown voltage degradation due to annealing at 650°C of Hf-Al-O alloyed film with Al mole fraction zero to 100%