Nucleation Studies of Thin Film Oxides using Atomic Layer Deposition

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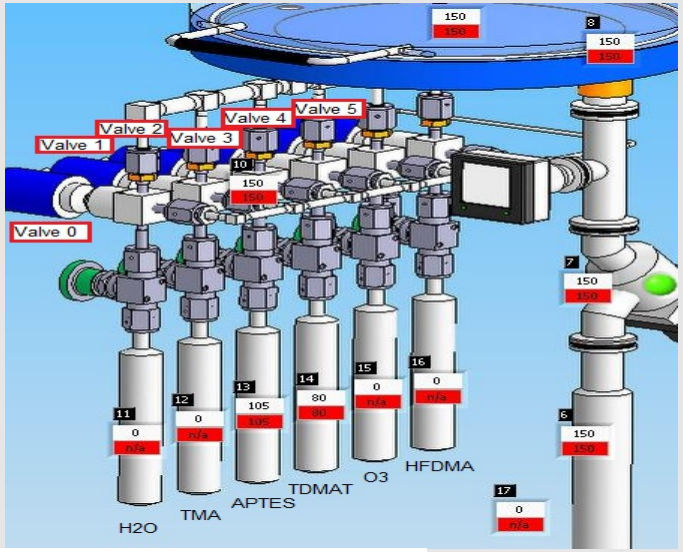
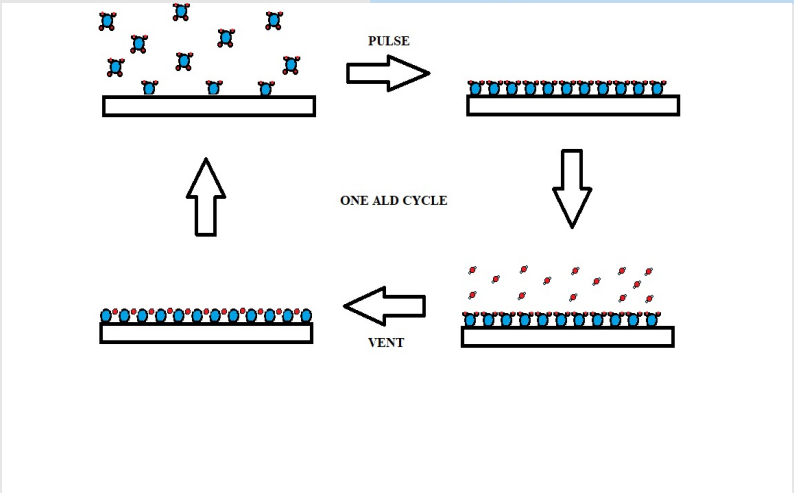
BACKGROUND

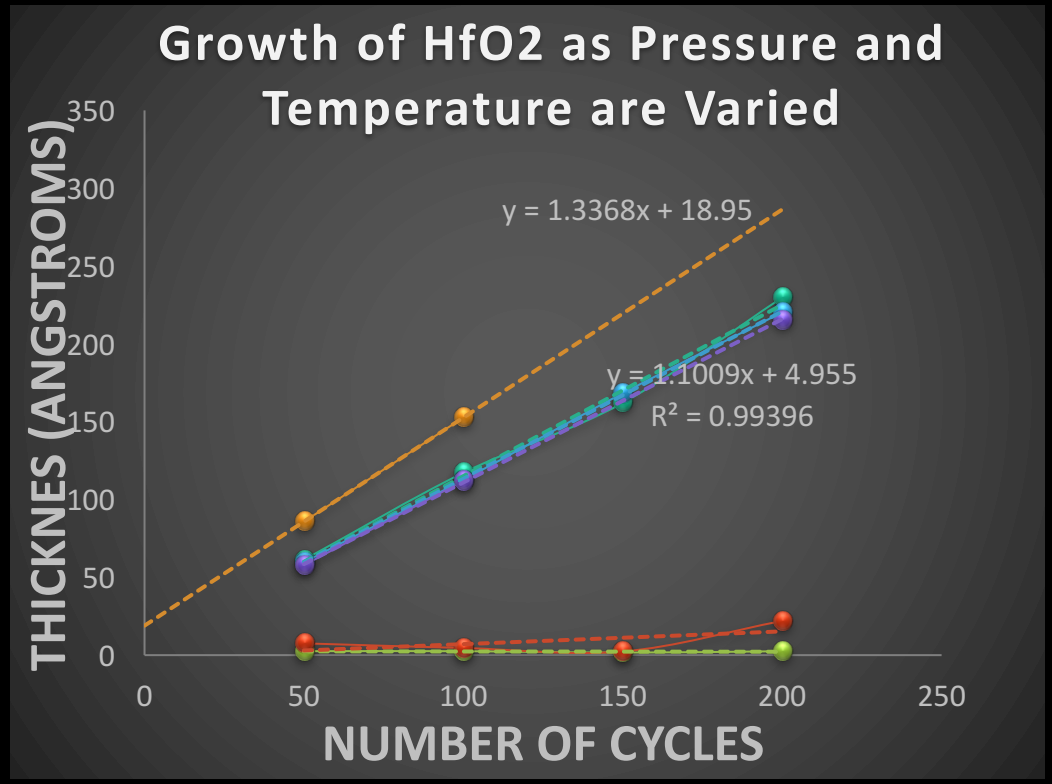
- ALD was discovered twice: once in the 60's by the soviet union, and again in the 70's by Finnish scientist Dr. Tuomo Suntola as a manufacturing process for flat panel displays
- Today ALD is pivotal in the manufacturing and development of photovoltaics, catalysis production and research, and semi-conductor devices
- ALD allows for the downscaling of micro and nano electronic devices





RESEARCH TOPICS AND RESULTS

GROWTH RATE AS PRESSURE IS VARIED



CHARACTERIZATION OF ALD GROWTH USING ABERRATION-CORRECTED JEOL STEM FOR ATOMIC RESOLUTION IMAGING

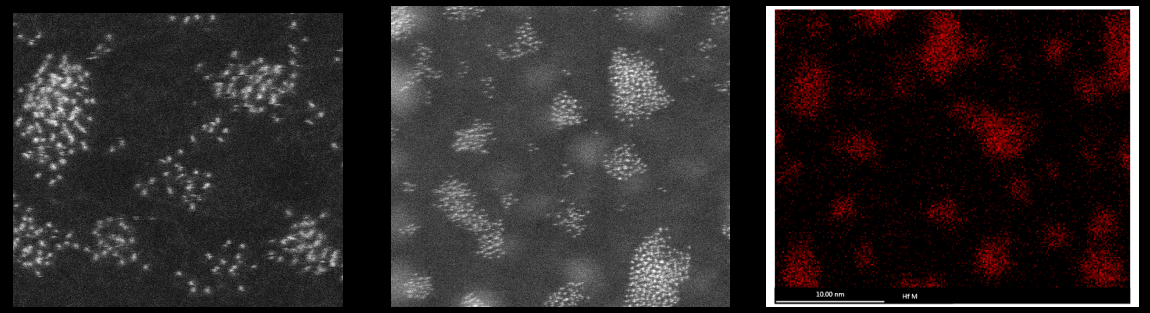


FIGURE 1. A) TEM imaging of HfO_2 atoms with 5cycles of growth at 2 nm. B) Stem imaging of HfO_2 atoms with 5 cycles of growth at 5 nm. C) EDX (Energy-Dispersive X-ray Spectroscopy) mapping of HfO_2 atoms. Photo Credits: Jules Gardener, Harvard CNS

CONCLUSIONS AND FUTURE STUDIES

- All pressure related growth rates had mixed results likely due to a clogged precursor manifold on the original ALD used
- Determination of positive high pressure results as being under CVD vs. ALD regime
- Visualization of ALD growth from 1-100 cycles of growth using STEM microscopy, or until complete film coverage is seen.
- STEM imaging has determined that the ALD process is not complete for anything below 5 cycles using HfO_2 and is contradictory to the commonly held notion that ALD produces complete film coverage from the first cycle onwards

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