Process results examples:

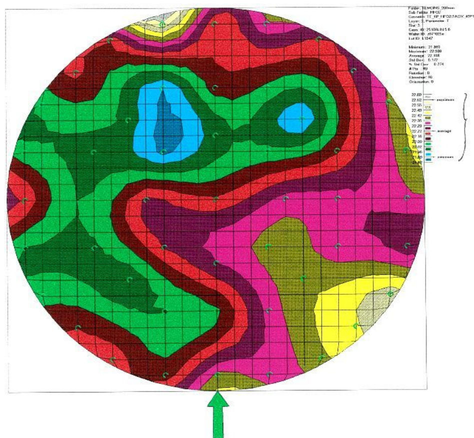
MOCVD Hf/Zr

• Process screening for Hf/Zr alloys

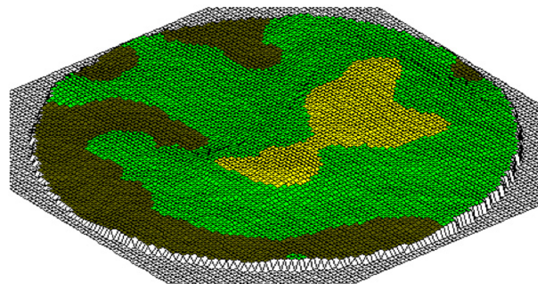
Film Type	Thickness range (nm)	Dep. Rate (nm/min)	Thick. Unif. (1σ %)	Injection parameters (Frequency, T_{on} gas, T_{on} liquid)
HfO_2 – 550°C	1.4 – 12.6	0.5 – 1	0.7 – 1.4	1Hz, 80ms, 4ms
HfO_2 – 400°C	4 – 32	0.6 – 0.8	0.8 – 2	1Hz, 80ms, 4ms
$HfZrO_x$ – 550°C	3 – 4	0.8 – 0.9	0.6 – 1.7	1Hz, 80ms, Hf=4ms/Zr=20ms
ZrO_2 – 400°C	1.5 – 30	0.1 – 0.5	0.9 – 2.6	1Hz à 0.4Hz, 80ms, 4ms

• MOCVD HfO_2: thickness mapping (200mm wafer)

AltaCVD enables tight control of nanometric films



2.2nm average thickness
Non-uniformity: 0.77%, 1σ
Amorphous film



13.8nm average thickness
Non-uniformity: 1.04%, 1σ
Polycrystalline film (monoclinic)