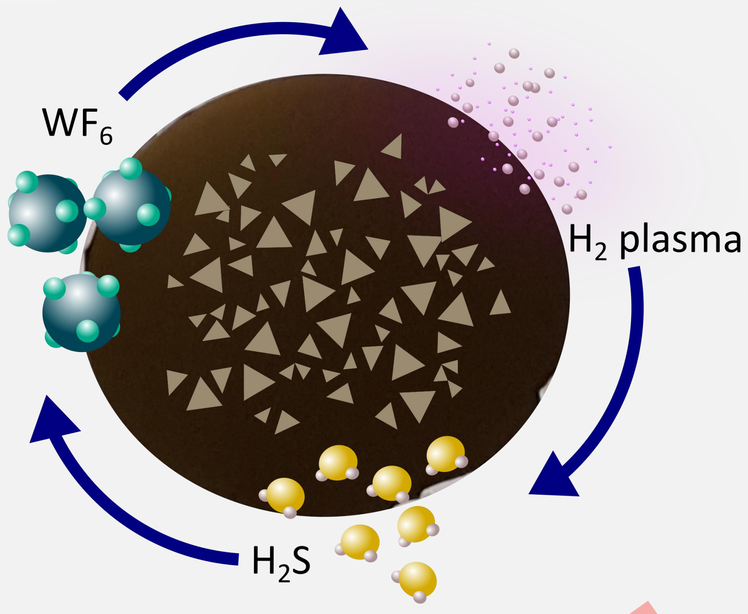
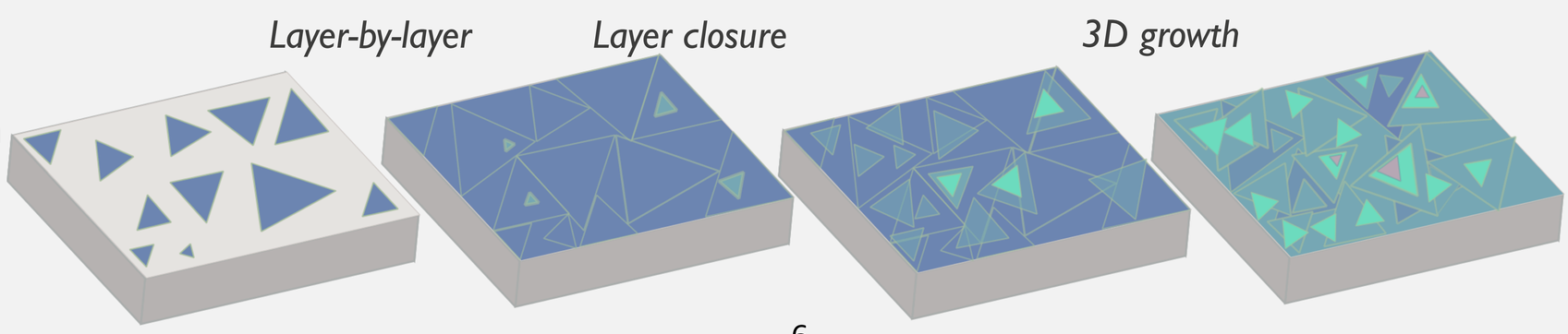
NUCLEATION OF PEALD WS_2 AND IMPACT ON GRAIN SIZE

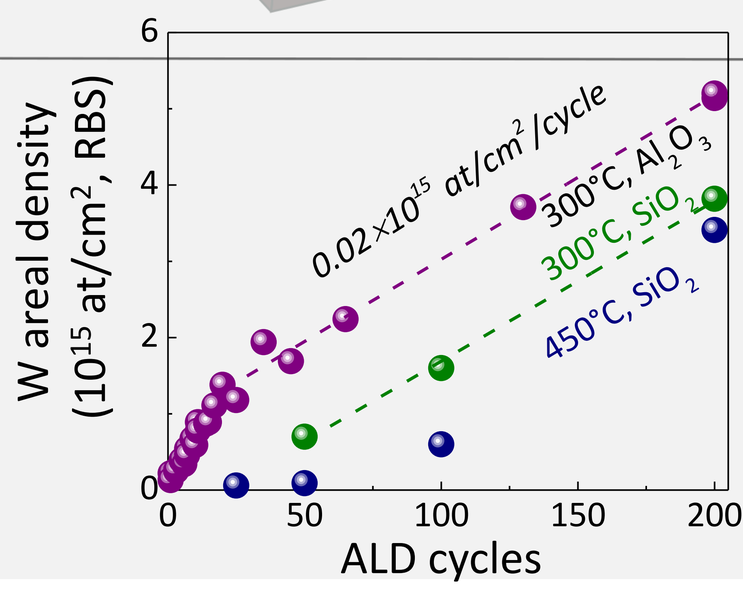
B. Groven[1,2], M. Caymax[1], M. Heyns[1,2], I. Radu[1], A. Delabie[1,2]

[1]IMEC, Leuven, Belgium,
[2] University of Leuven (KU Leuven), Leuven, Belgium



Growth model





Nucleation density — Grain size

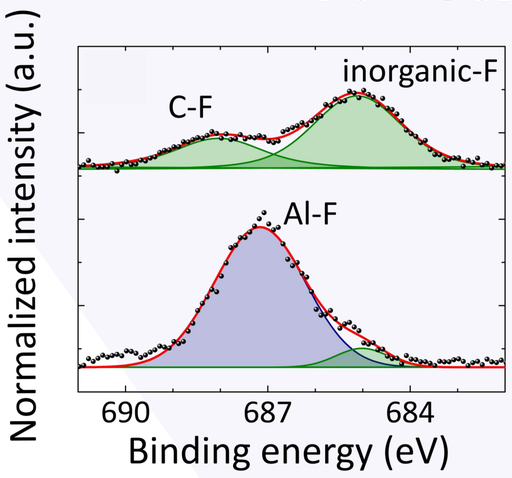
MINIMIZE BY,

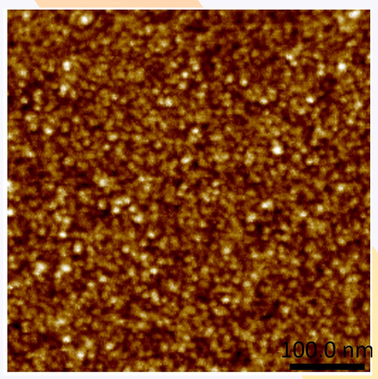
- **Deposition T ↑**
- Reactivity to **substrate ↓**

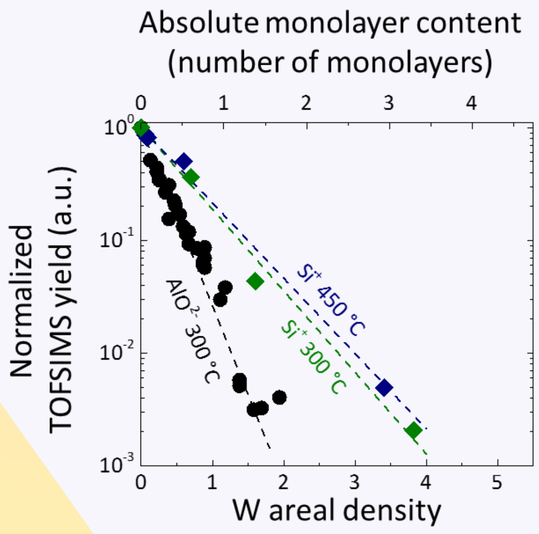
MAXIMIZE BY,

- Promoting **lateral growth**

10^{14} /cm² — 5-30 nm







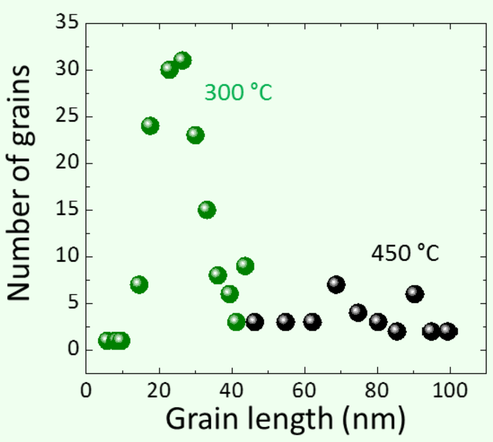
T=300°C, ON ALD Al_2O_3

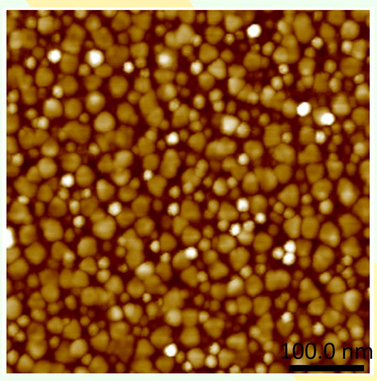
- **High nucleation density**
- Strong reaction with Al_2O_3 (Al-F, XPS)
- Fast layer closure (TOFSIMS) – **limits grain size**

T=300°C, ON DRY THERMAL SiO_2

- Reactivity to SiO_2 decreases (F, XPS) – **nucleation density ↓**
- **Lateral growth** from WS_2 nuclei – crystal **grain size ↑**

10^{11} /cm² — 10-40 nm



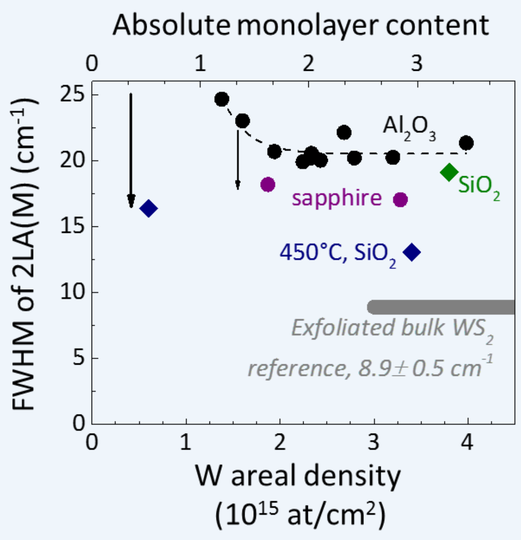


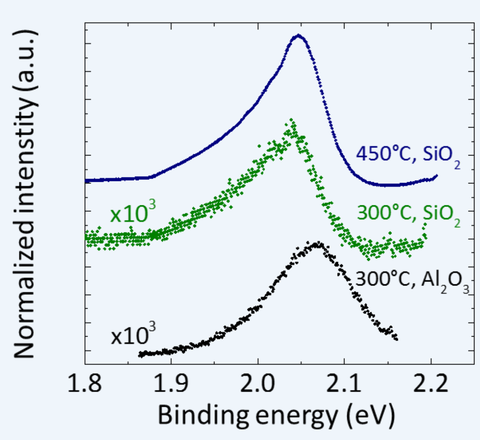
	F areal density (10^{15} at/cm², XPS)
Al_2O_3	3.4
SiO_2	0.3

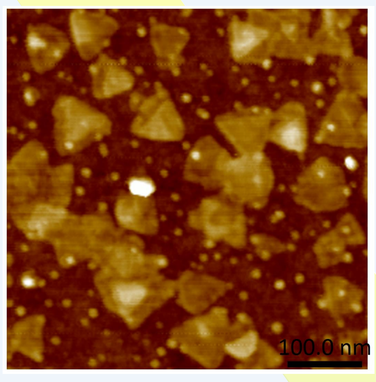
T=450°C, ON DRY THERMAL SiO_2

- **At higher T:**
  - **Surface diffusion** ad-atoms ↑
  - Crystal **grains up to 100 nm**
- **2D structure improves** (Raman, PL fwhm ~0.08 eV)

10^{10} /cm² — 40-100 nm







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