SP B monitoring meeting 2024

# SP B.4 - production of W reference samples

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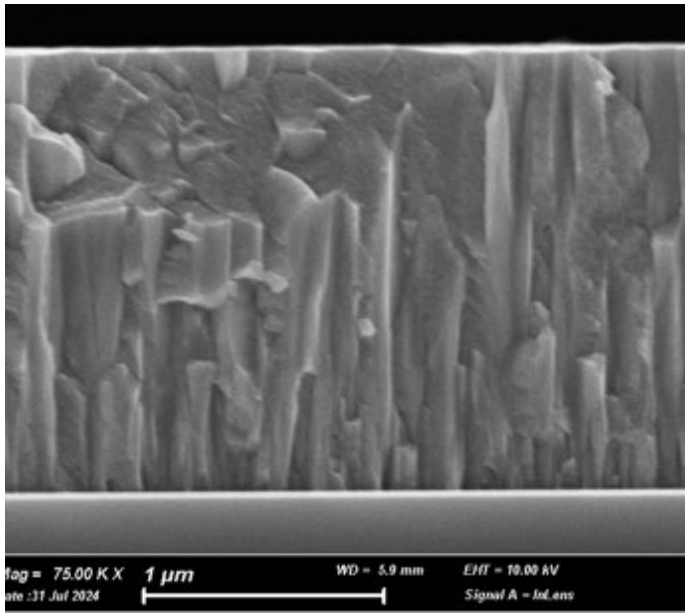
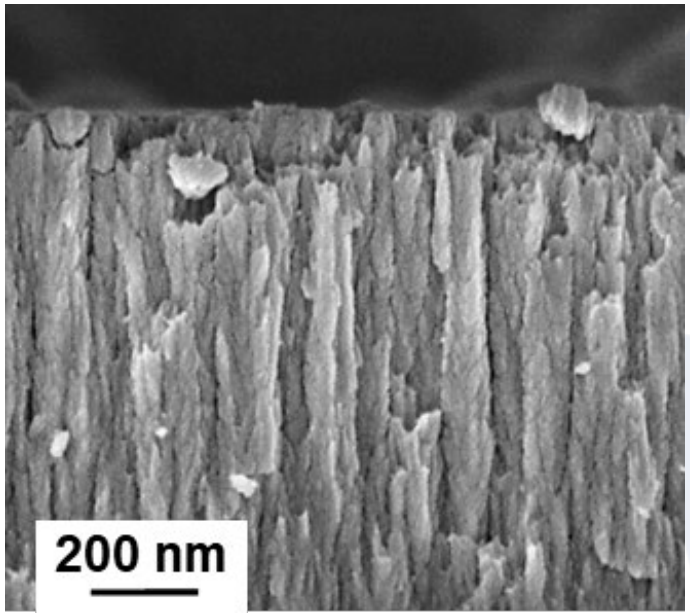
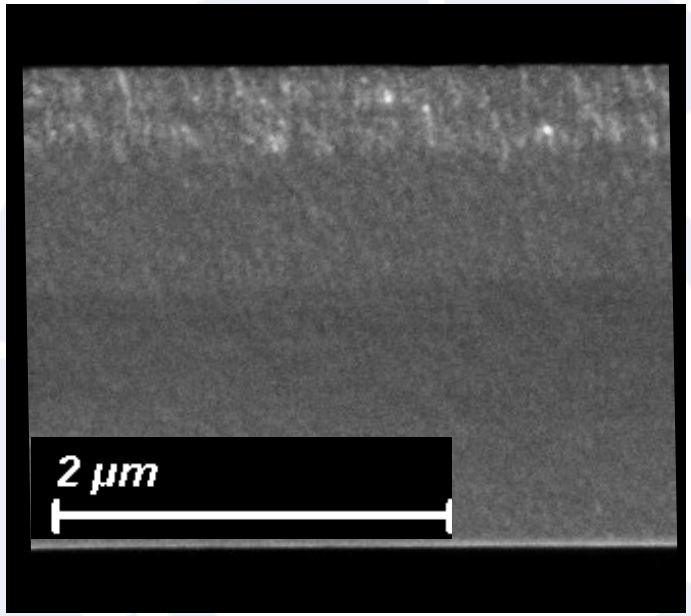
# Different kinds of W films deposited in 2024



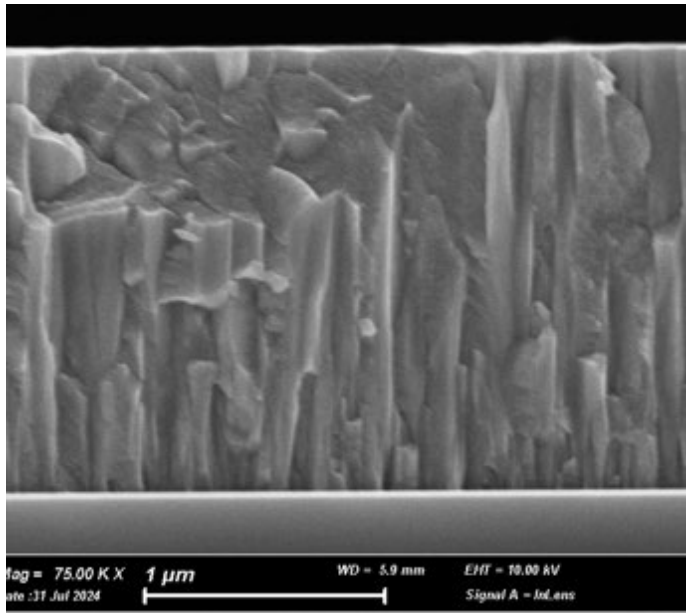



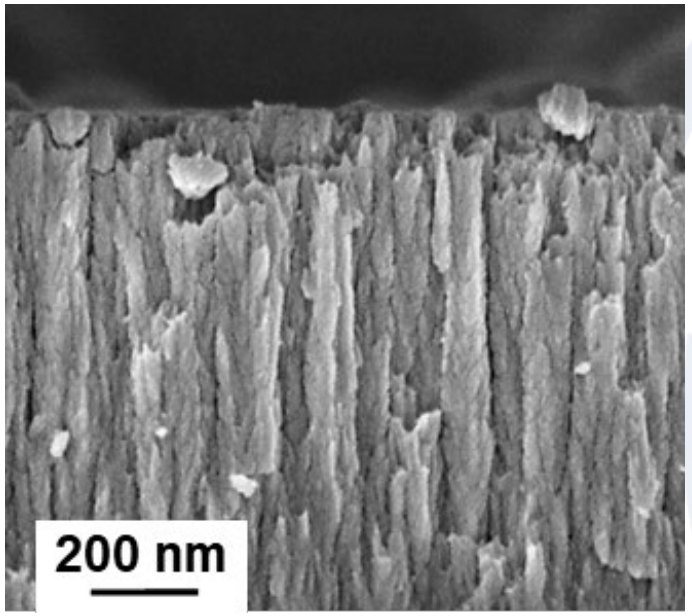

Compact W
- Compact → low surface area
- Crystalline
- Produced by HiPIMS and RF MS

- Porous W
- high surface area
- Nanocrystalline – Amorphous
- Produced by PLD (with Ar gas)

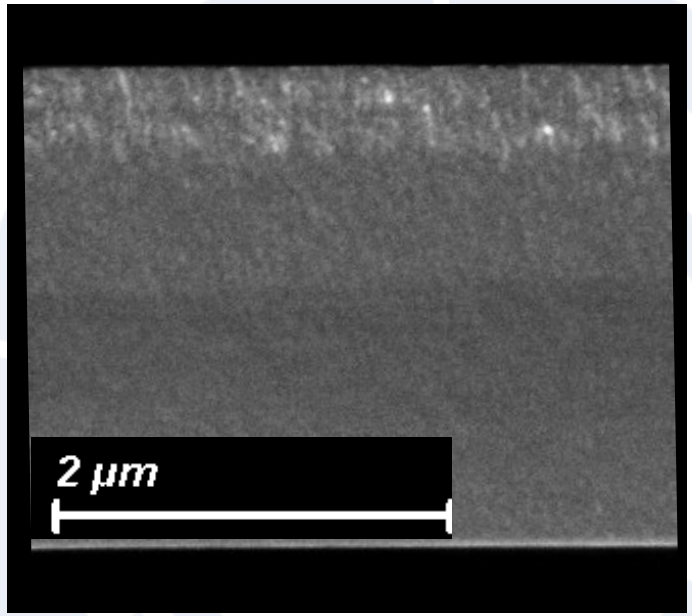
Amorphous W
- Compact → low surface area
- Amorphous
- Produced by PLD (with He gas)

# Different kinds of W films deposited in 2024



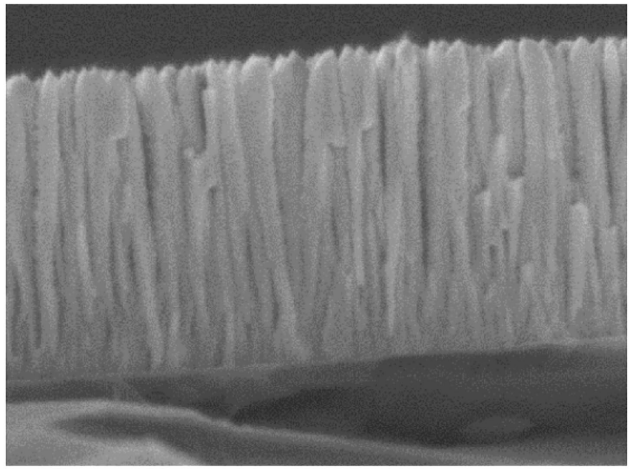



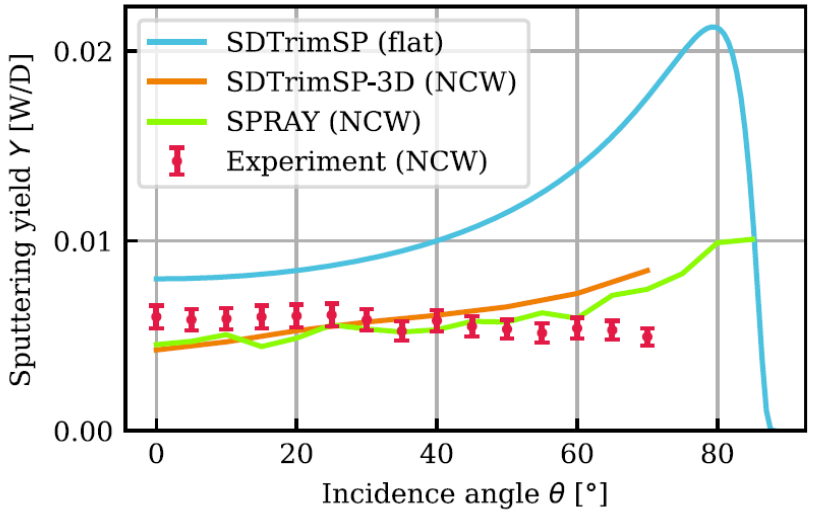

- To be used in LIBS campaign at DIFFER
- Exposures in GyM and PSI-2




- dust impact studies at ENEA-CNR Milan
- sputtering Yield studies at MPG.

# Deposit a new kind of W sample: Nanocolumnar W






**R. Gonzalez-Arrabal et al., NME 40 (2024), 101704**

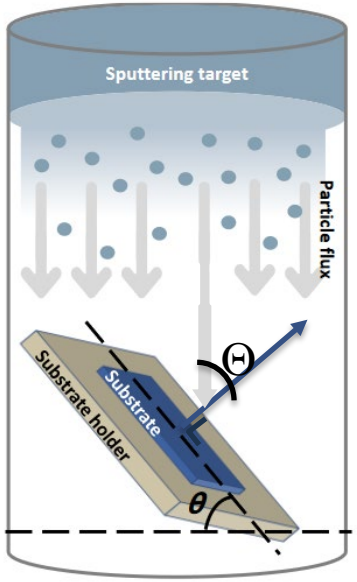
**J. Brötzner et al., NME 37 (2024), 101507**

Nanocolumnar W

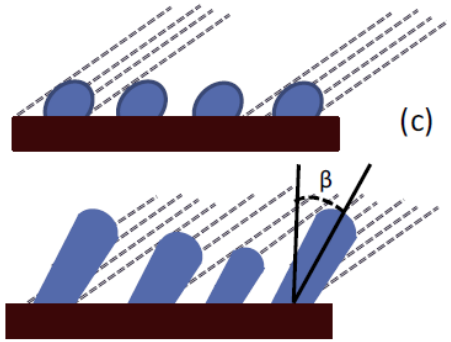
- high surface area
- Crystalline
- Produced by tilted magnetron sputtering

Reduced sputtering yield under D ions

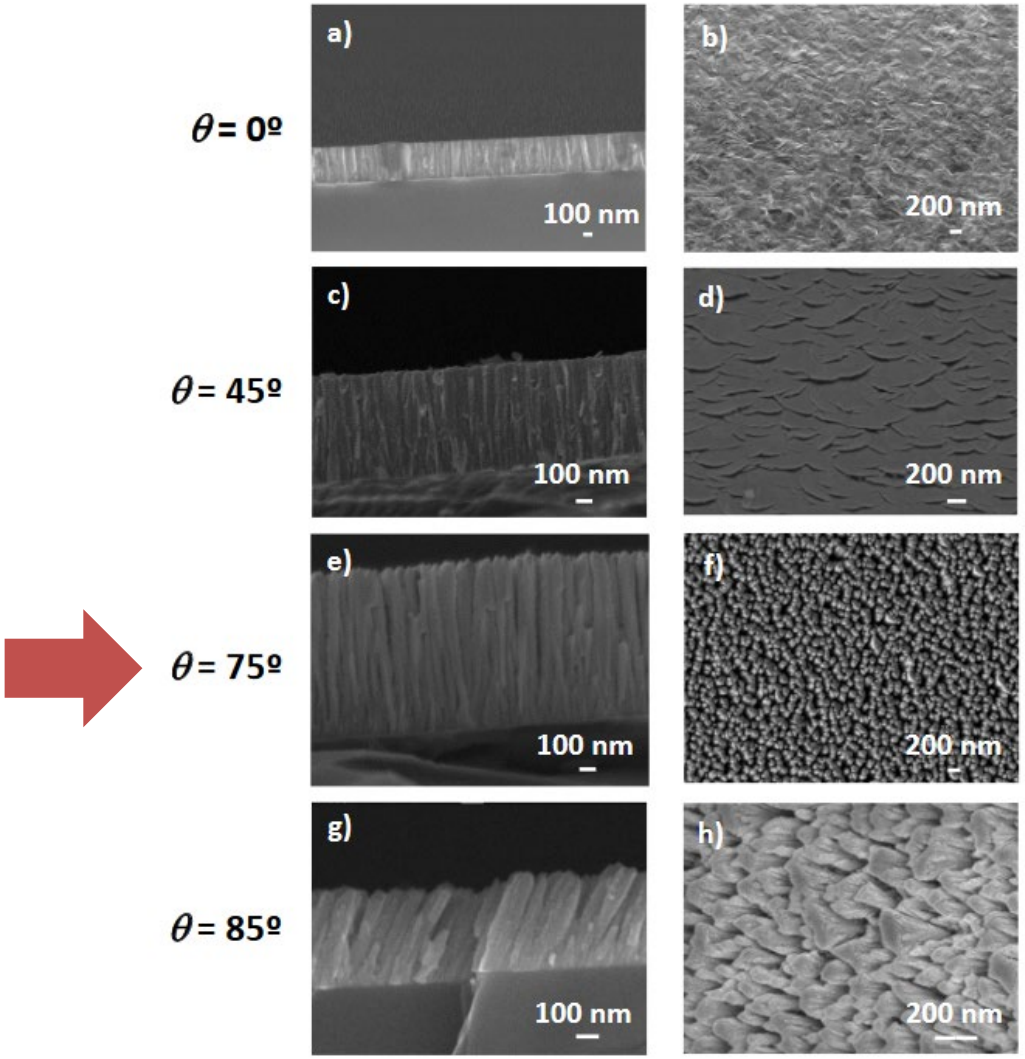
# Tilted magnetron sputtering deposition



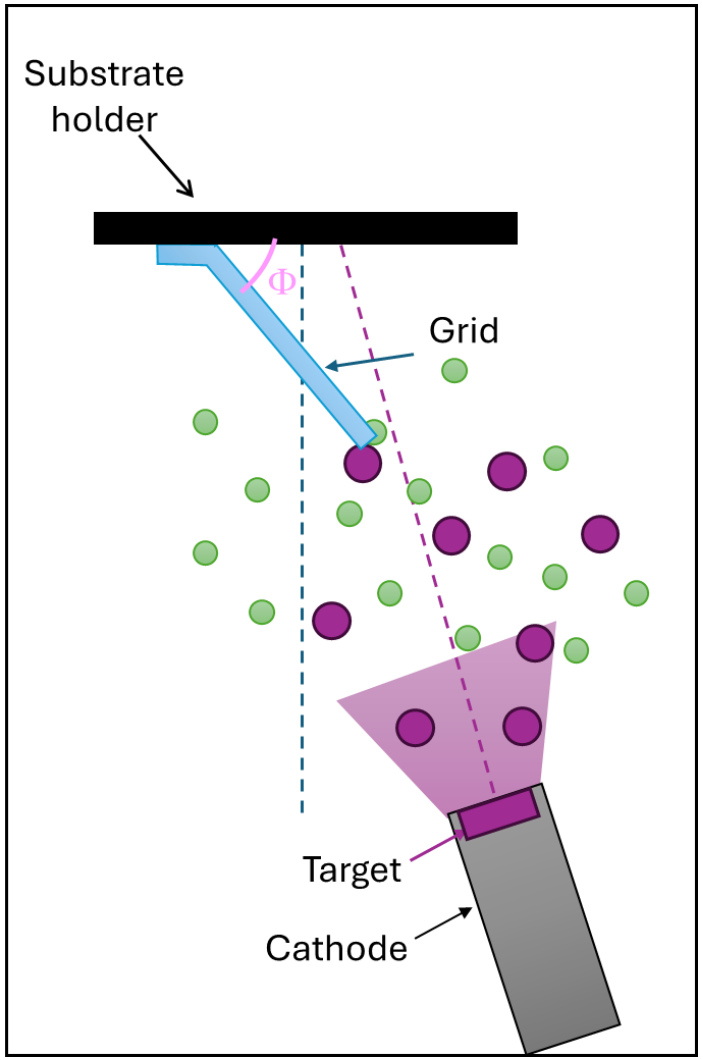

Tilted substrate deposition




Shadowing effect



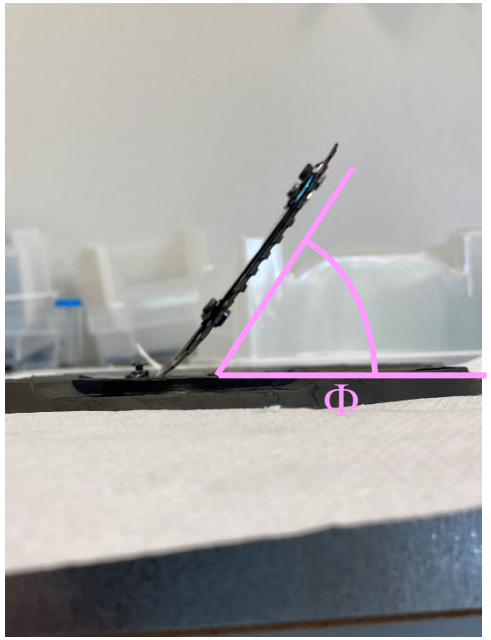
# Our depostions: experimental setup



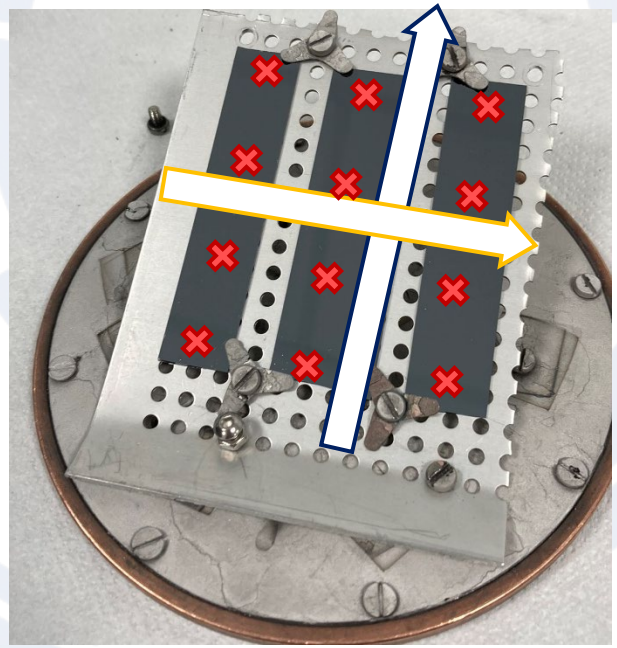

- Samples are mounted on a bent grid
- DC sputtering at different working gas pressure and cathode power

Experimental parameters:
- Target-holder distance: <16 cm
- Target diameter: 3 inch
- Ar pressure: 0.4-1.2 Pa
- DC cathode power: 50-100W
- Θ angle: 0-85°

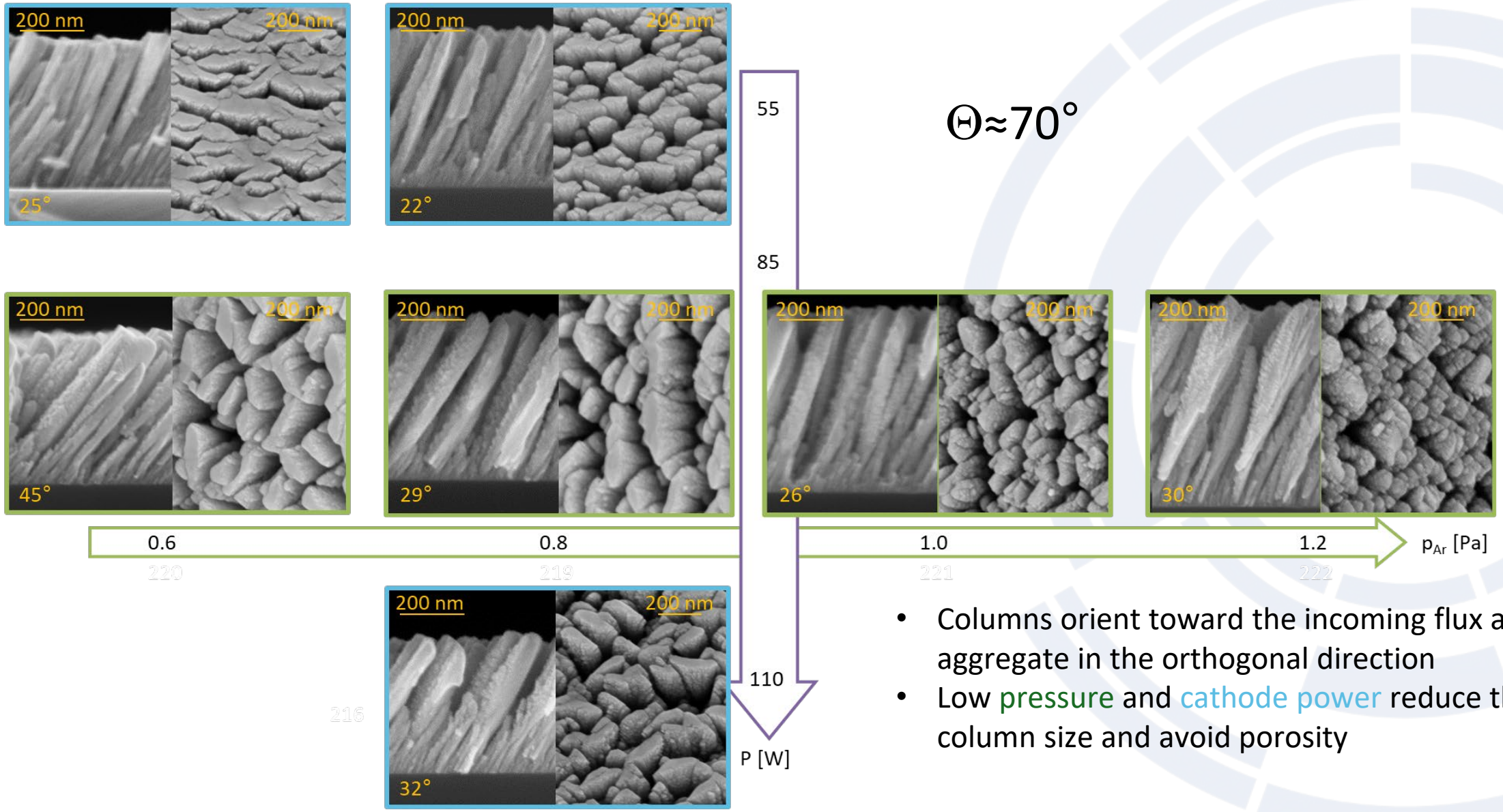
- After the deposition: Film thickness, morphology and uniformity.







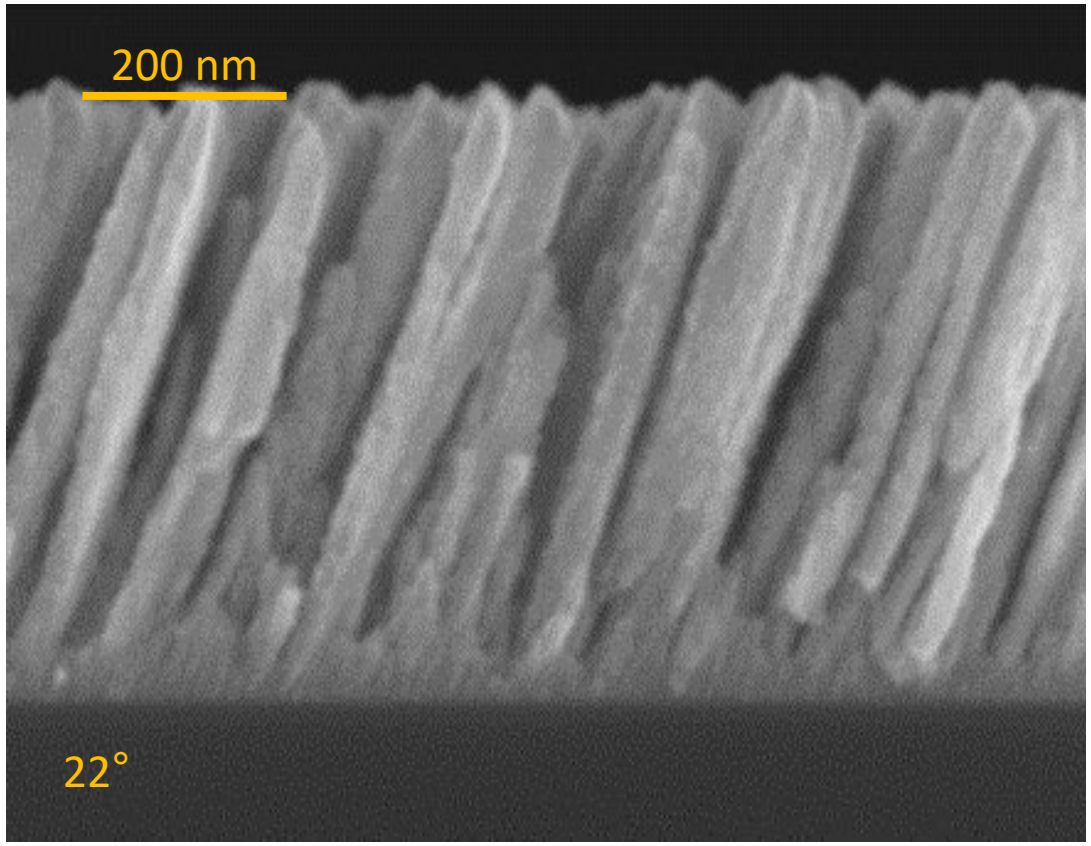
# Effect of pressure and cathode power

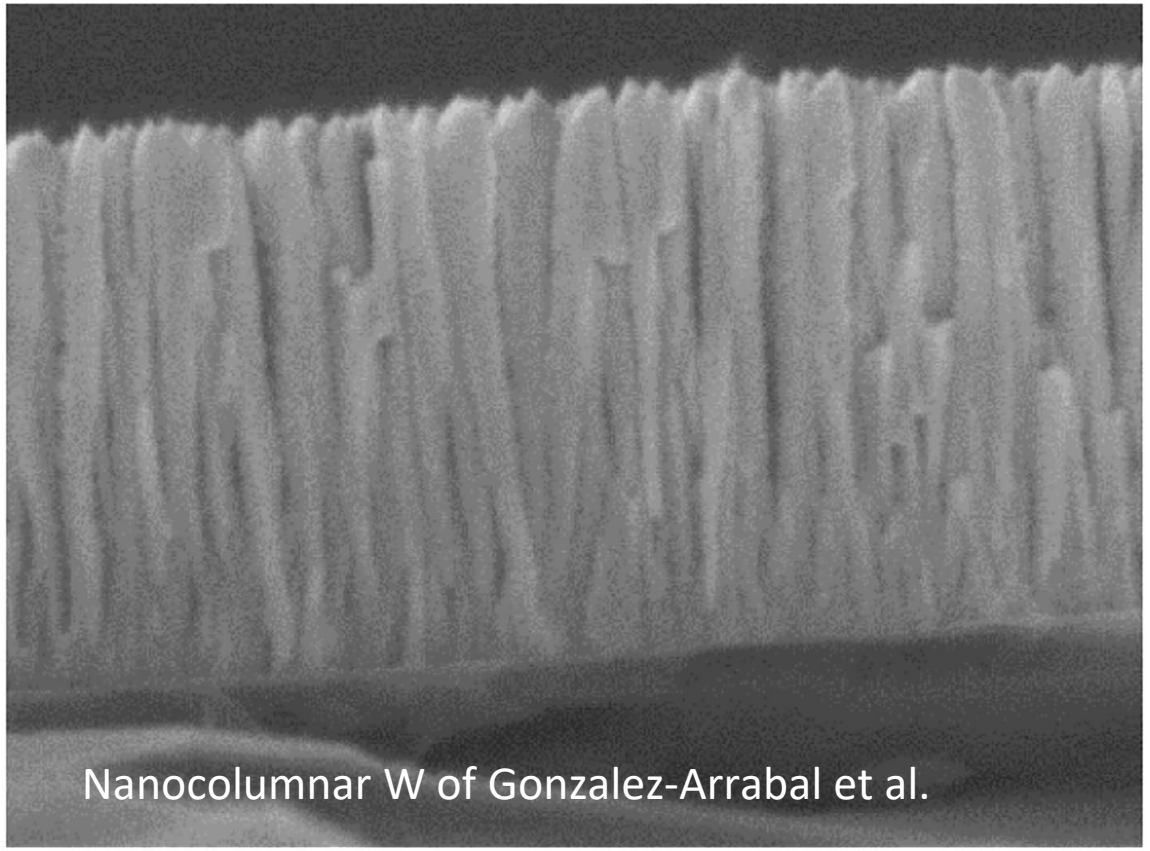



$\Theta \approx 70°$

- Columns orient toward the incoming flux and aggregate in the orthogonal direction
- Low pressure and cathode power reduce the column size and avoid porosity

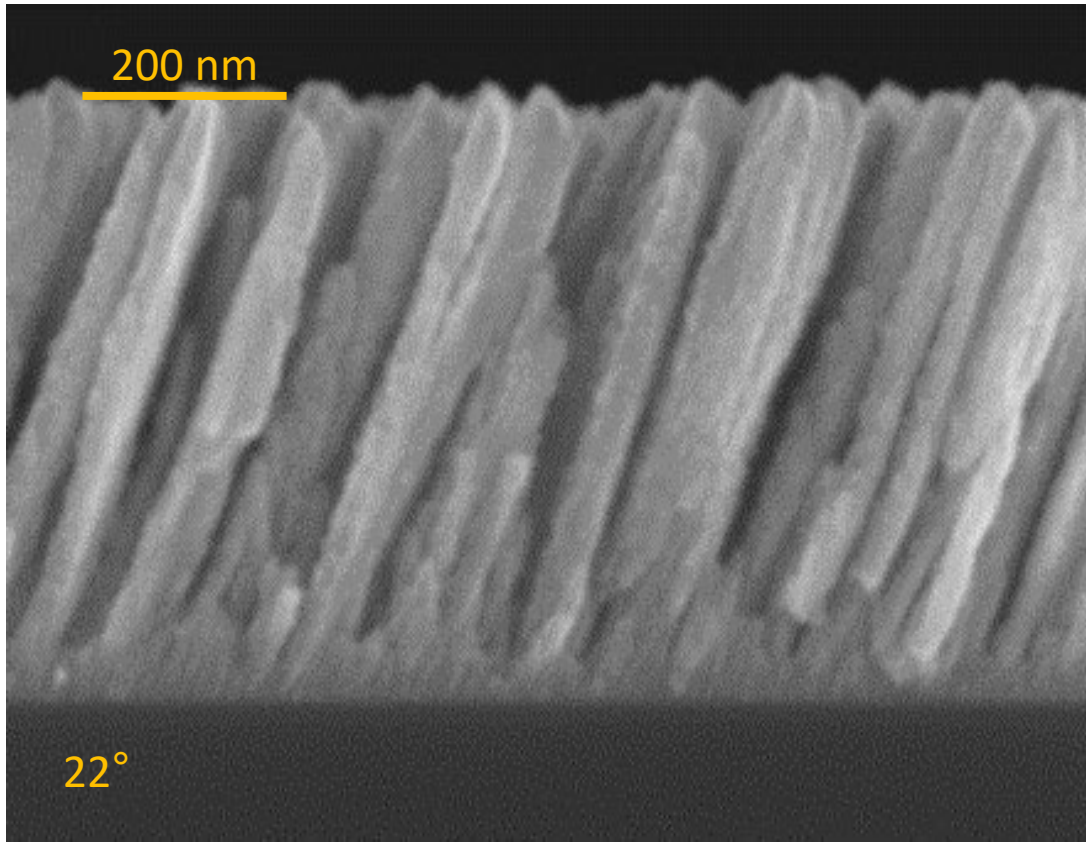
# Comparison with the literature




The tilt angle of the grid Θ is a critical and very sensible parameter
→ not easy to reproduce the perpendicular growth

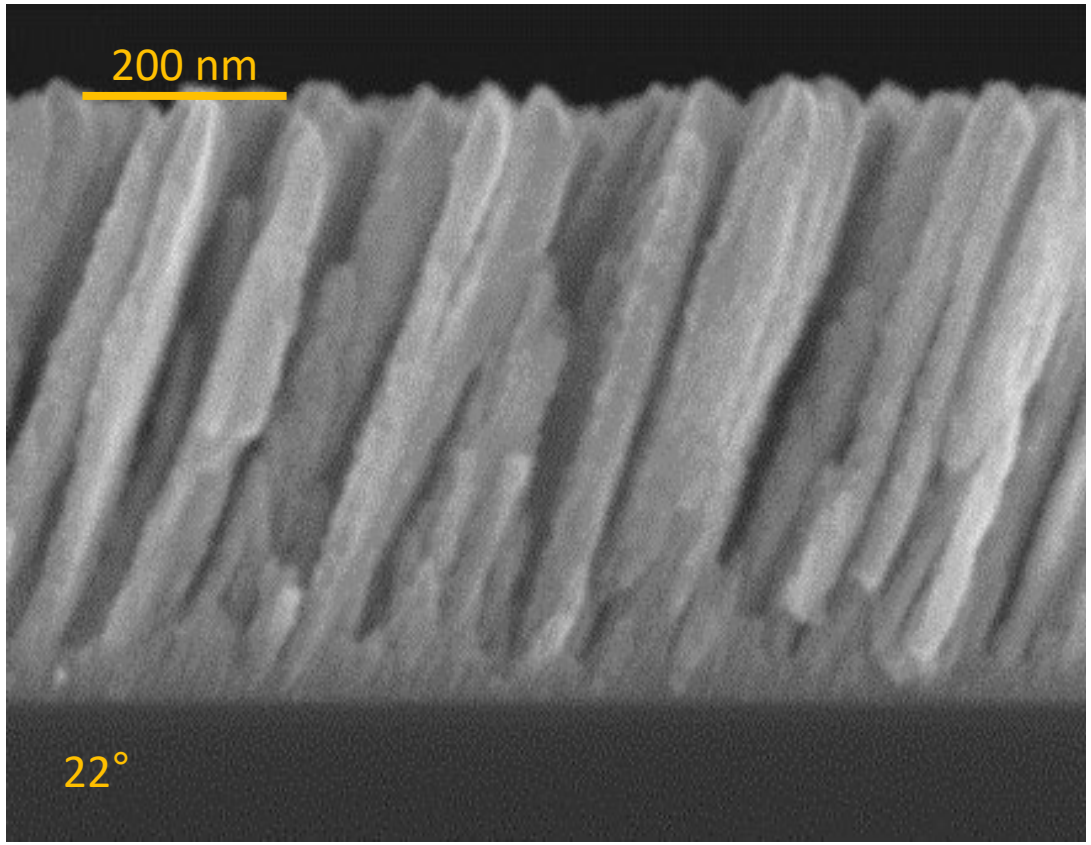
# Tilted Nanocolumnar W




Influence of Italy?

The famous Pisa tower

# Tilted Nanocolumnar W

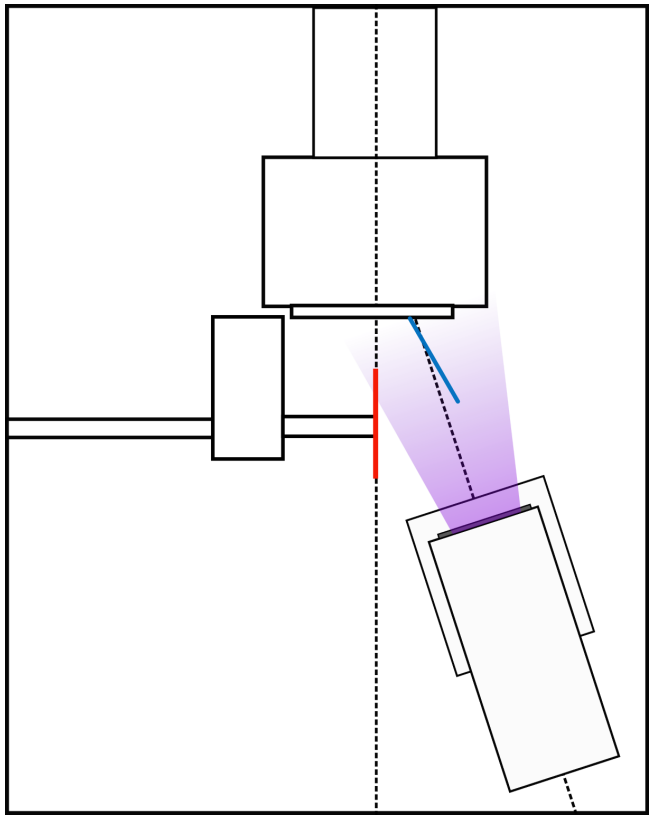


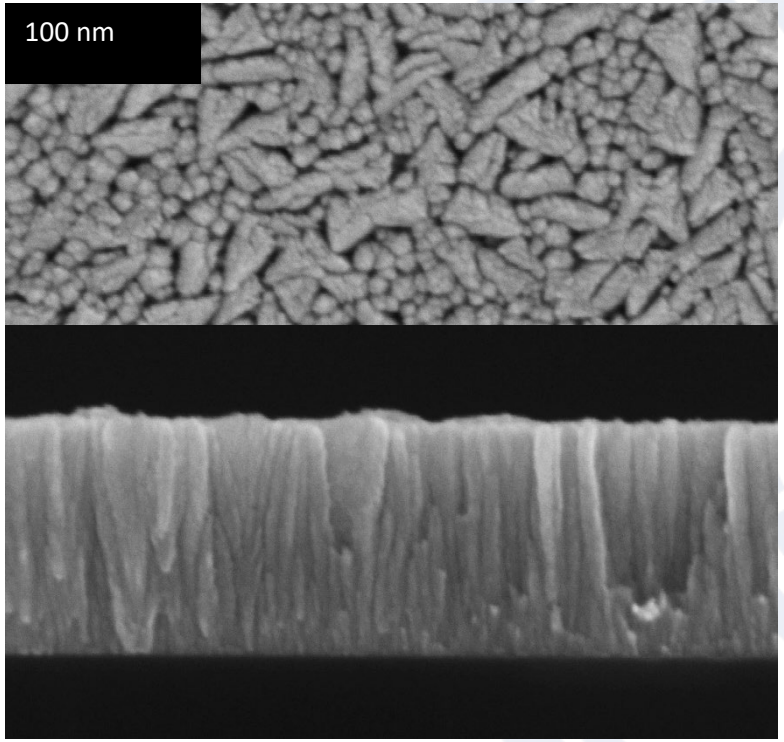

Nanocolumnar W

- Columns 50 nm wide
- Columns microns long
- Tilt angle 22°: interesting for anisotropic effects
- Deposition of the 17 foreseen samples is ongoing in October
- Ready for deliverable in end of October – beginning of November

# Future developments – rotating substrate

New rotating holder






Deposition conditions:

$p_{Ar}$ = 0.8 Pa

$P_W$ = 85 W

$\Delta t$ = 45 min