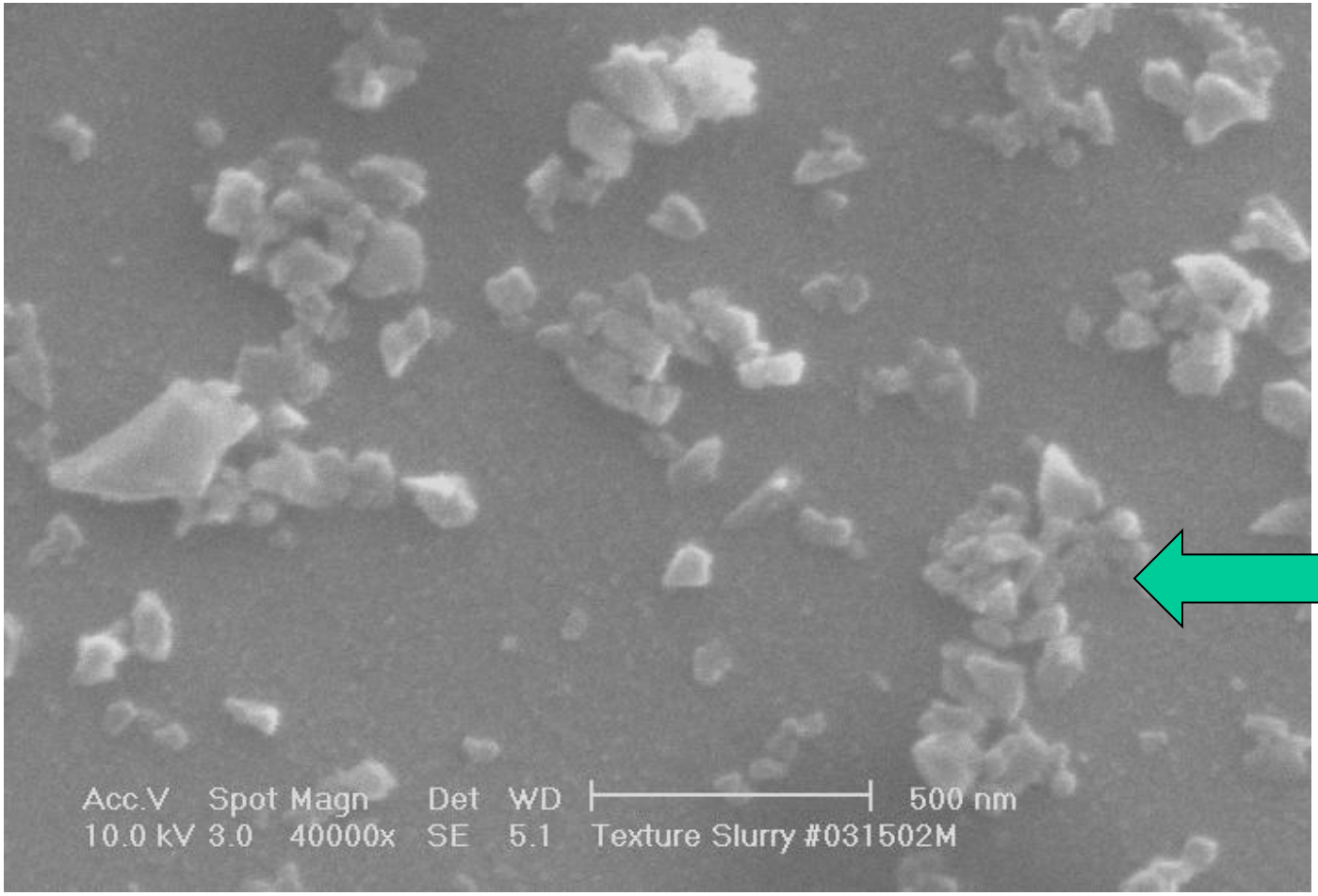
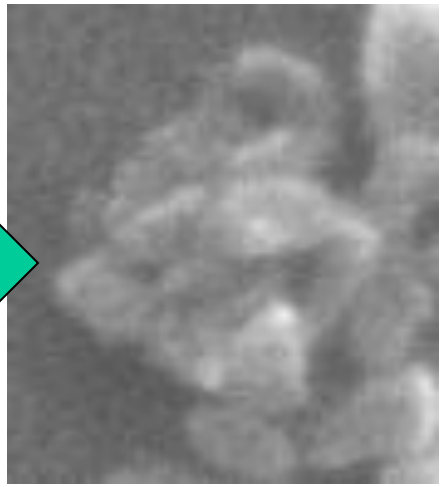
# Texture-Induced hcp *c-axis* Alignment in Longitudinal Media

**B. G. Demczyk**

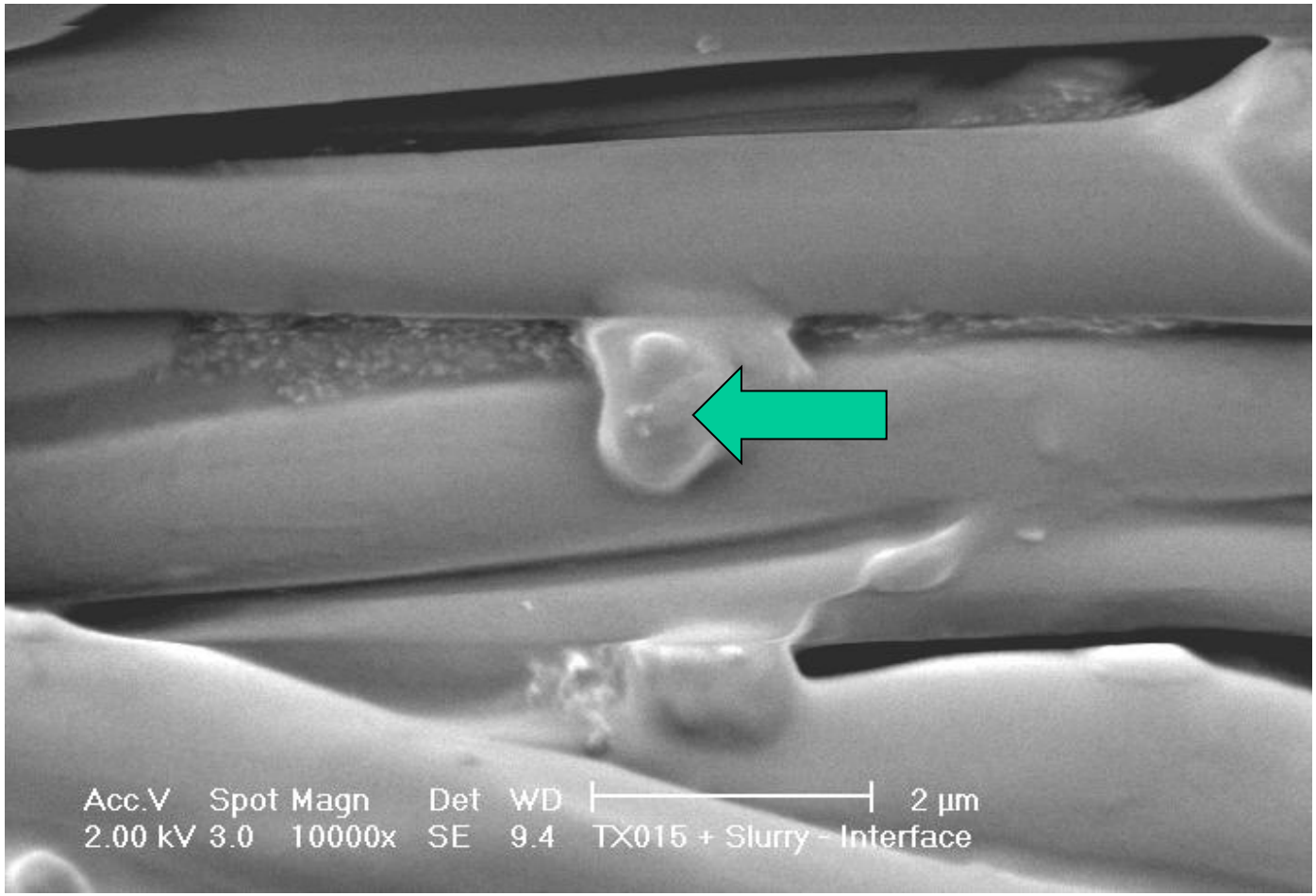
# Texture Slurry



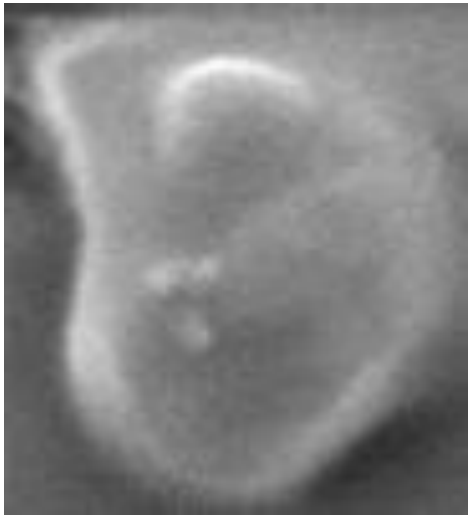

**Numerous Facets Account for Fine Texture Features**



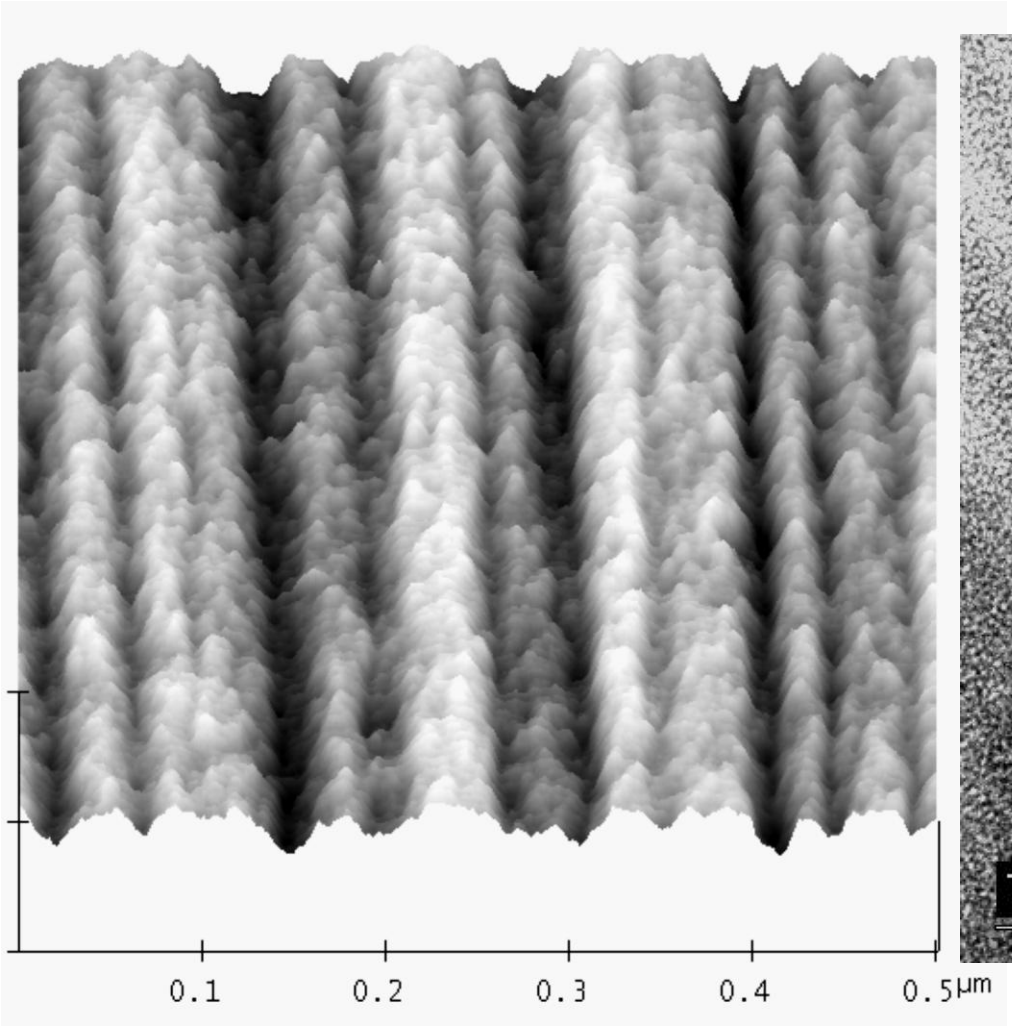
# Texture Tape (with Slurry&Coolant)

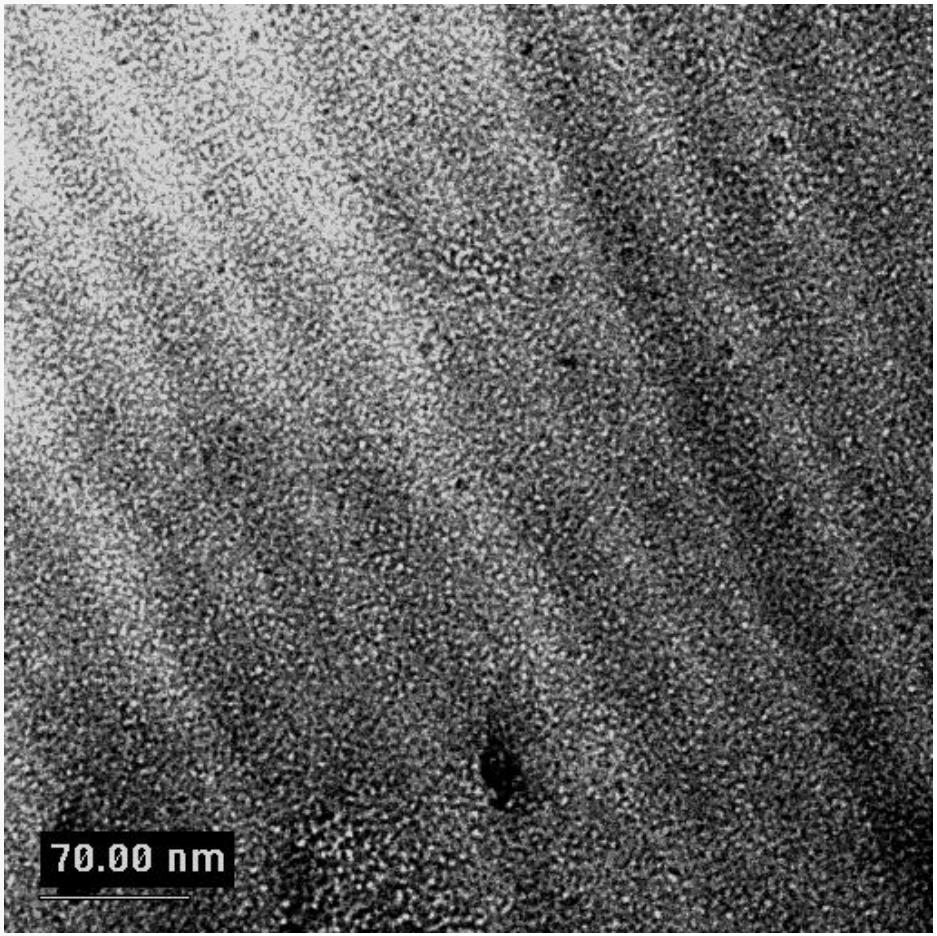



**Coolant "Encapsulates" Diamond Particle Aggregate**



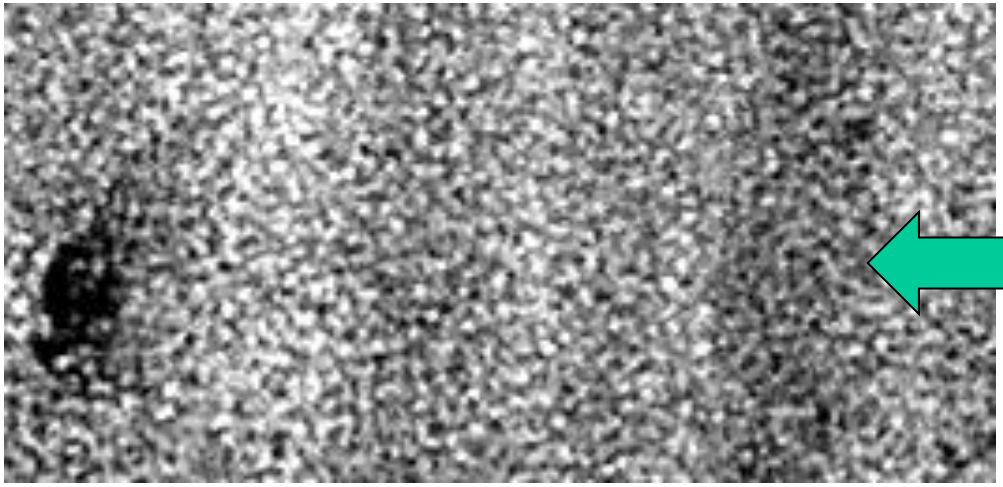
# Textured NiP Substrate



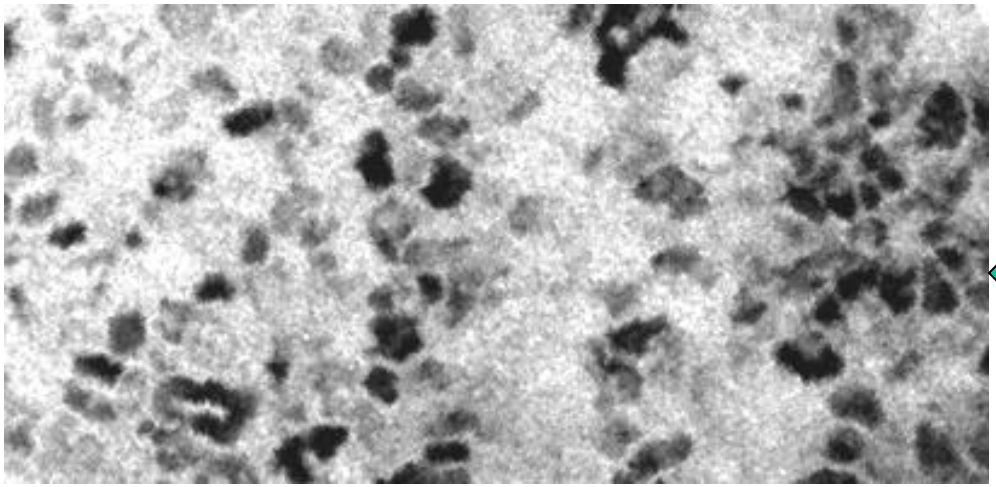



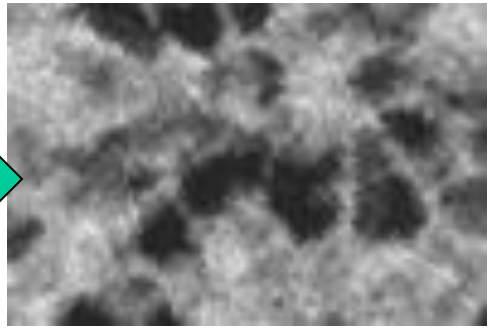

NiP-plated layer is “amorphous”

# Textured NiP Substrate & Finished Disk

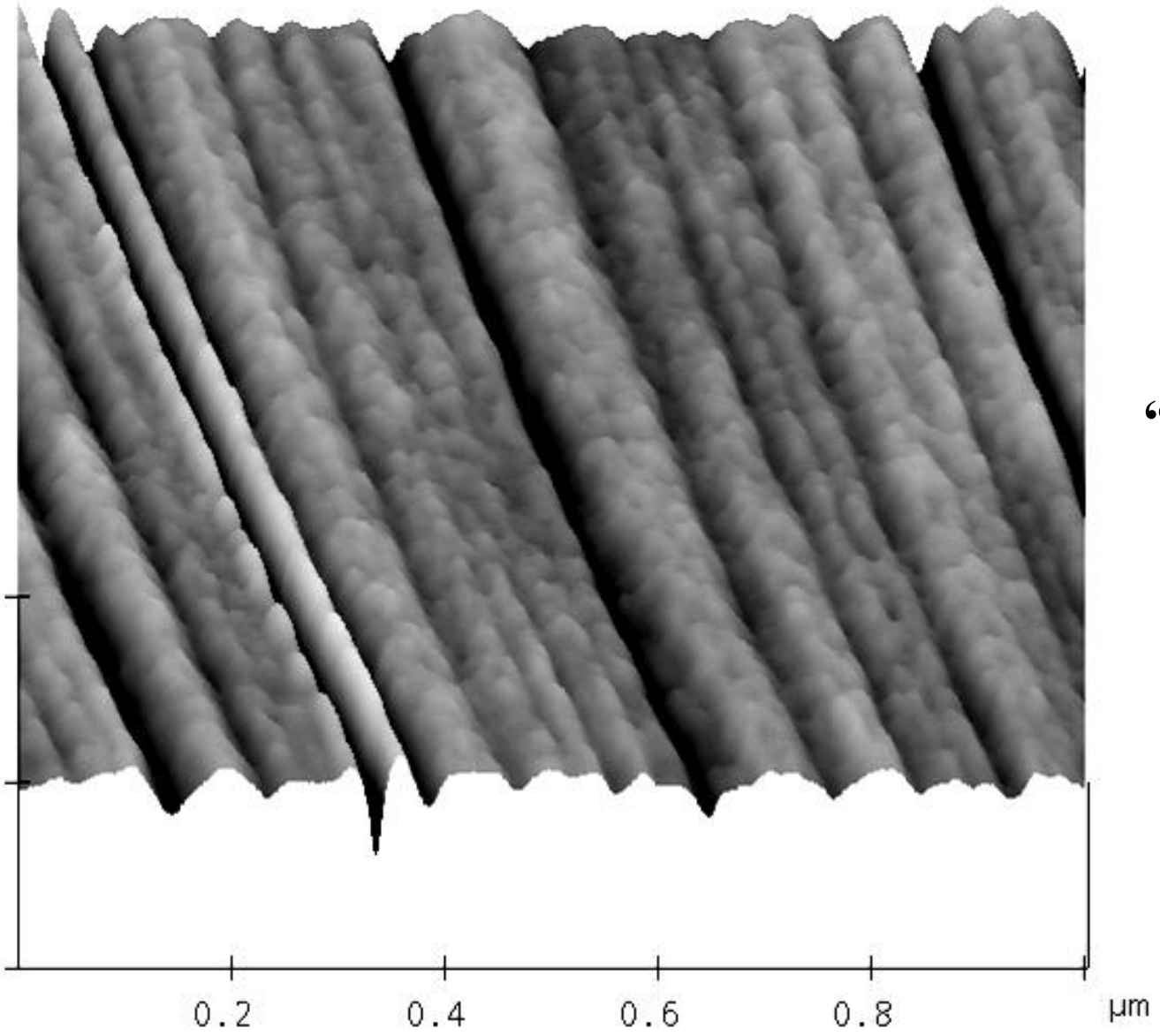



**As many as 5+ Grains per "Texture Groove"**



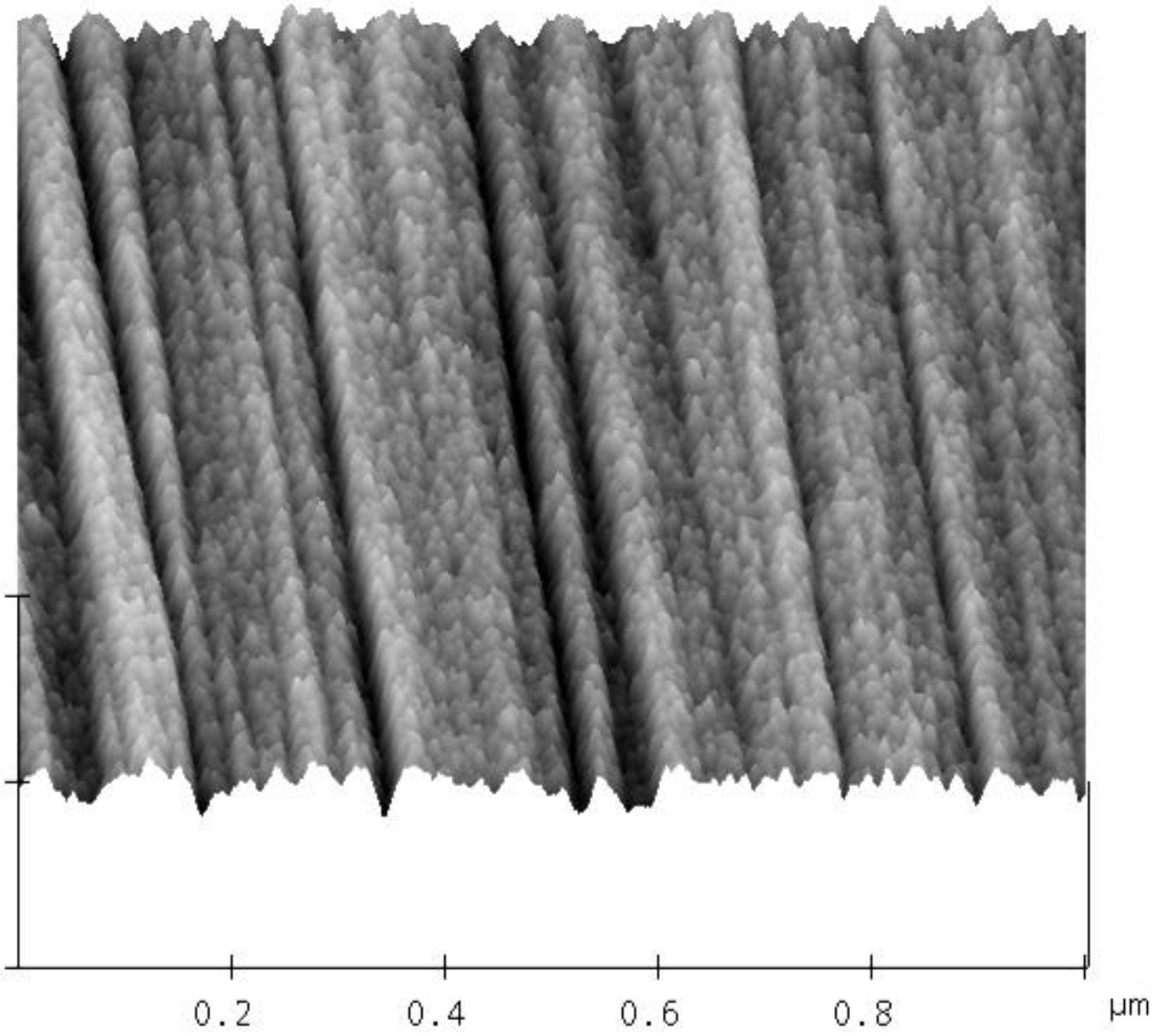


# Finished Disk (OR=1.2; $R_a$ = 0.40 nm)



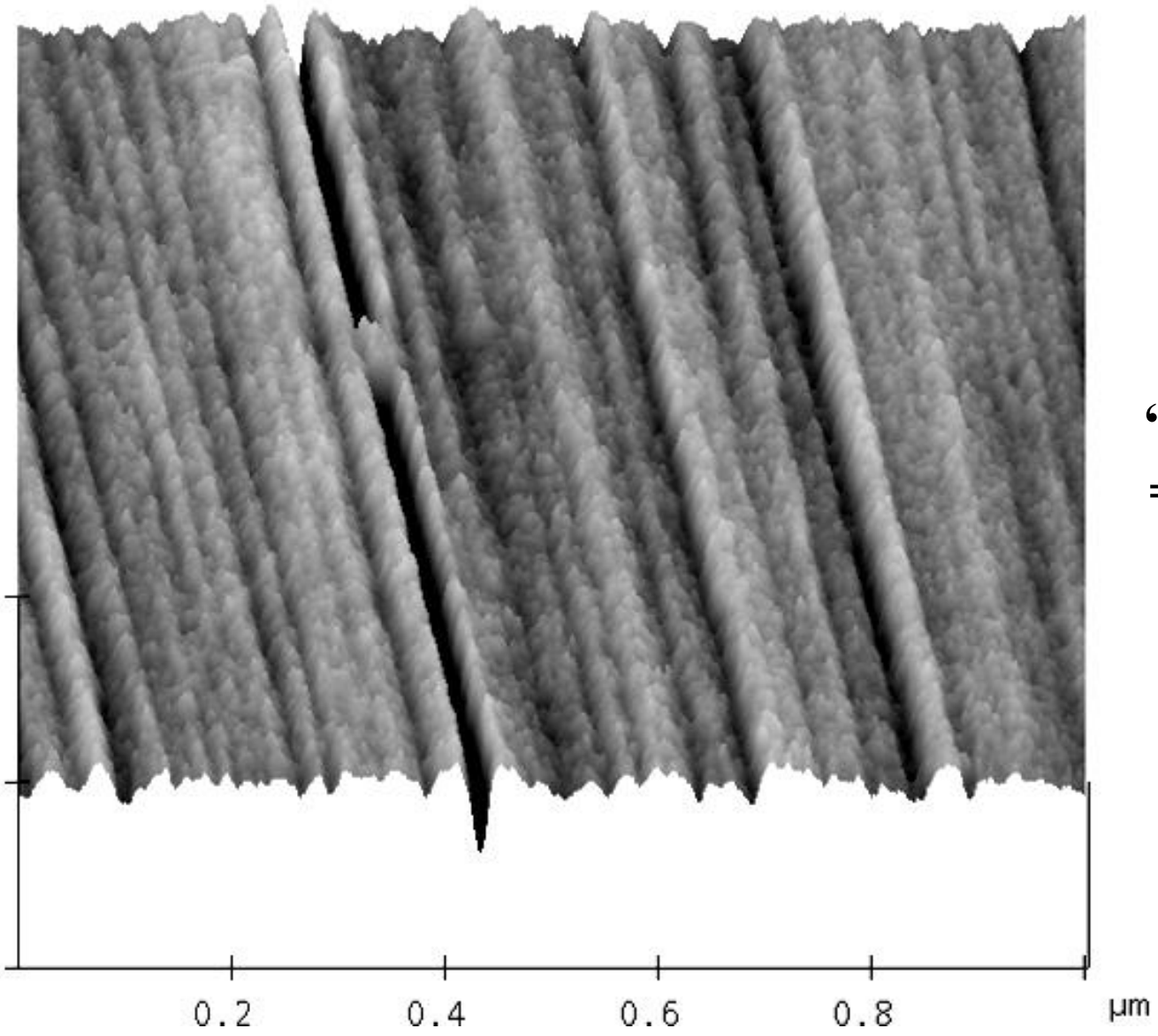

**"Line Density" = "Low"**

# Finished Disk (OR=1.6; $R_a$ = 0.42 nm)



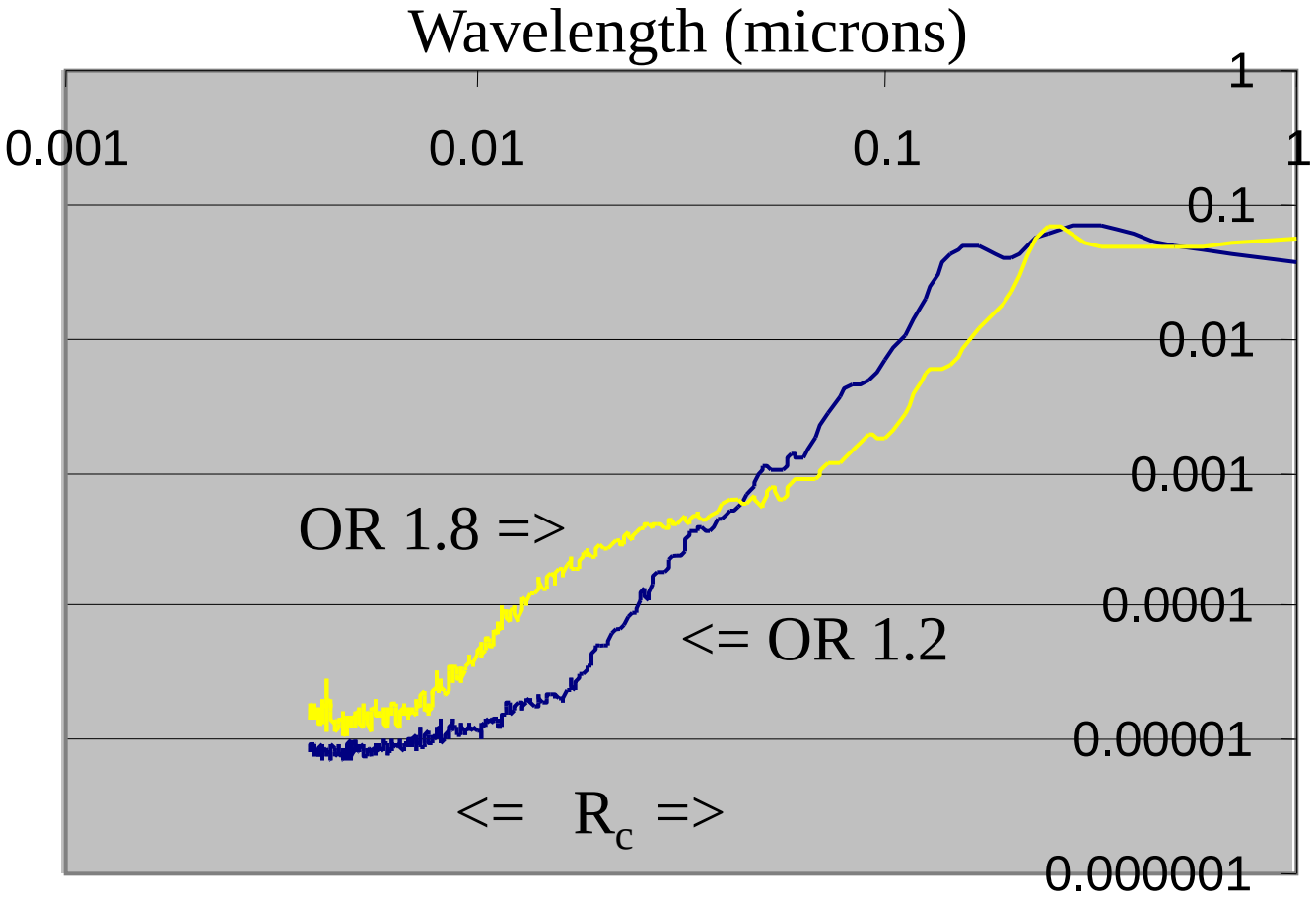

**"Line Density" = "High"**

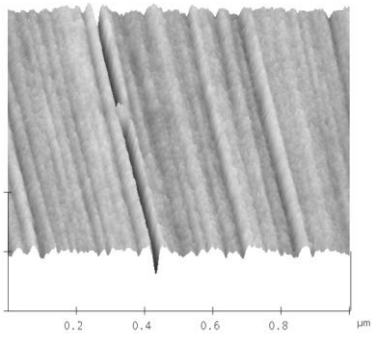
# Finished Disk (OR=1.8; $R_a$ = 0.42 nm)



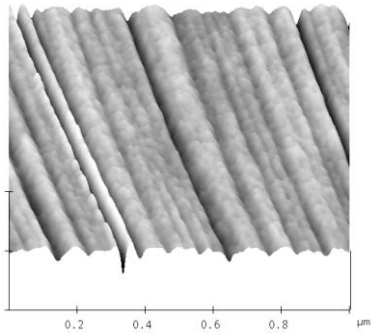

**"Line Density" = "High(er)?"**

# Circumferential PSD vs. OR *("Smooth" Disks)*



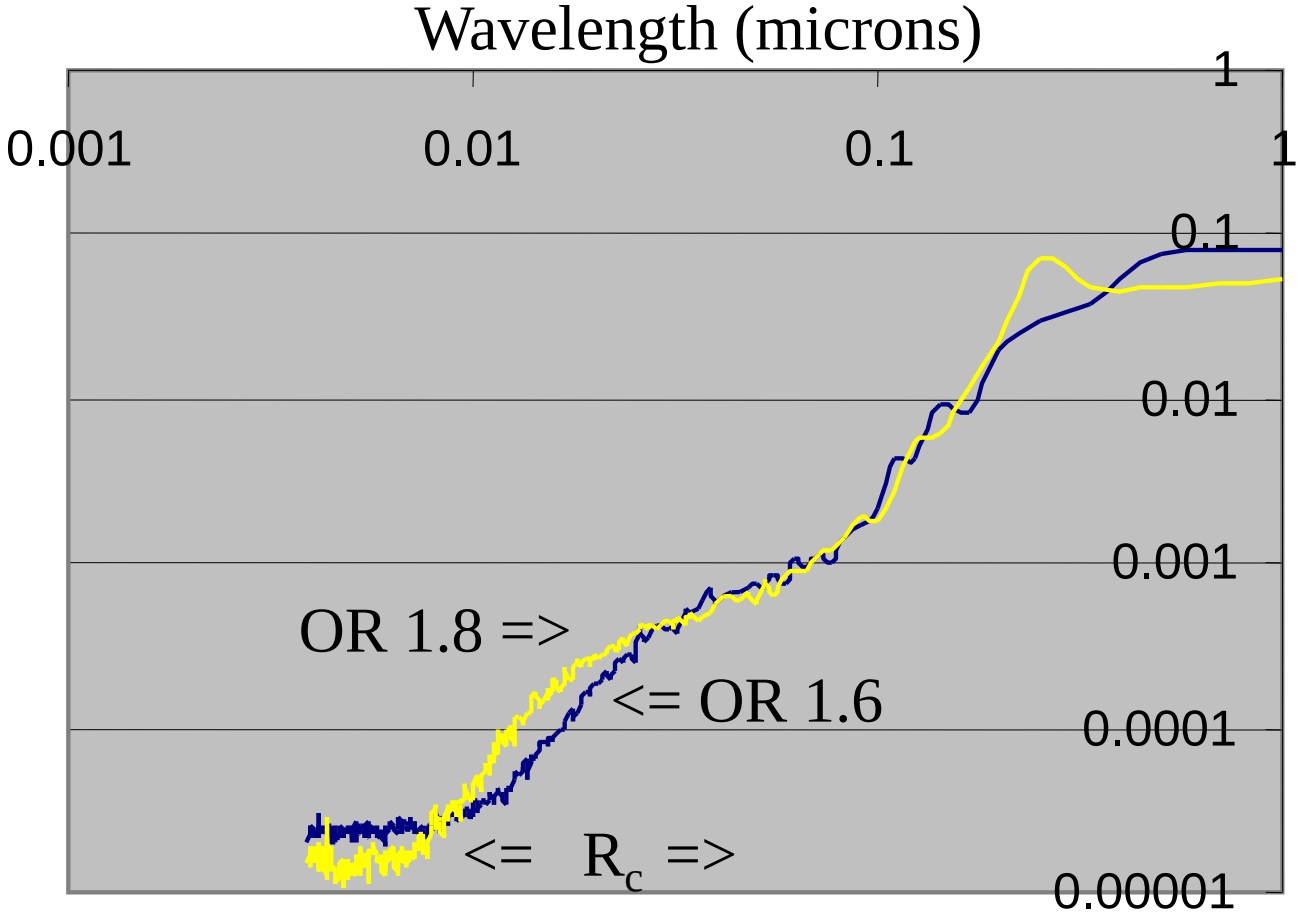



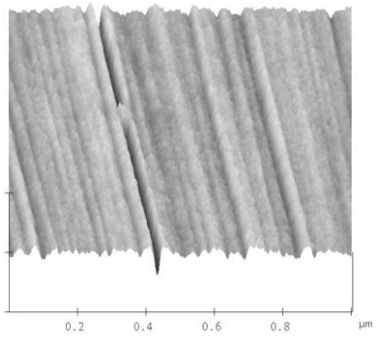
$R_c$ = .14 nm



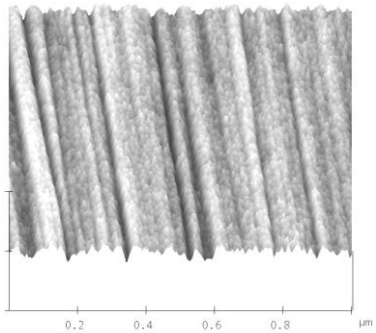
$R_c$ = .08 nm

# Circumferential PSD vs. OR *("Smooth" Disks)*



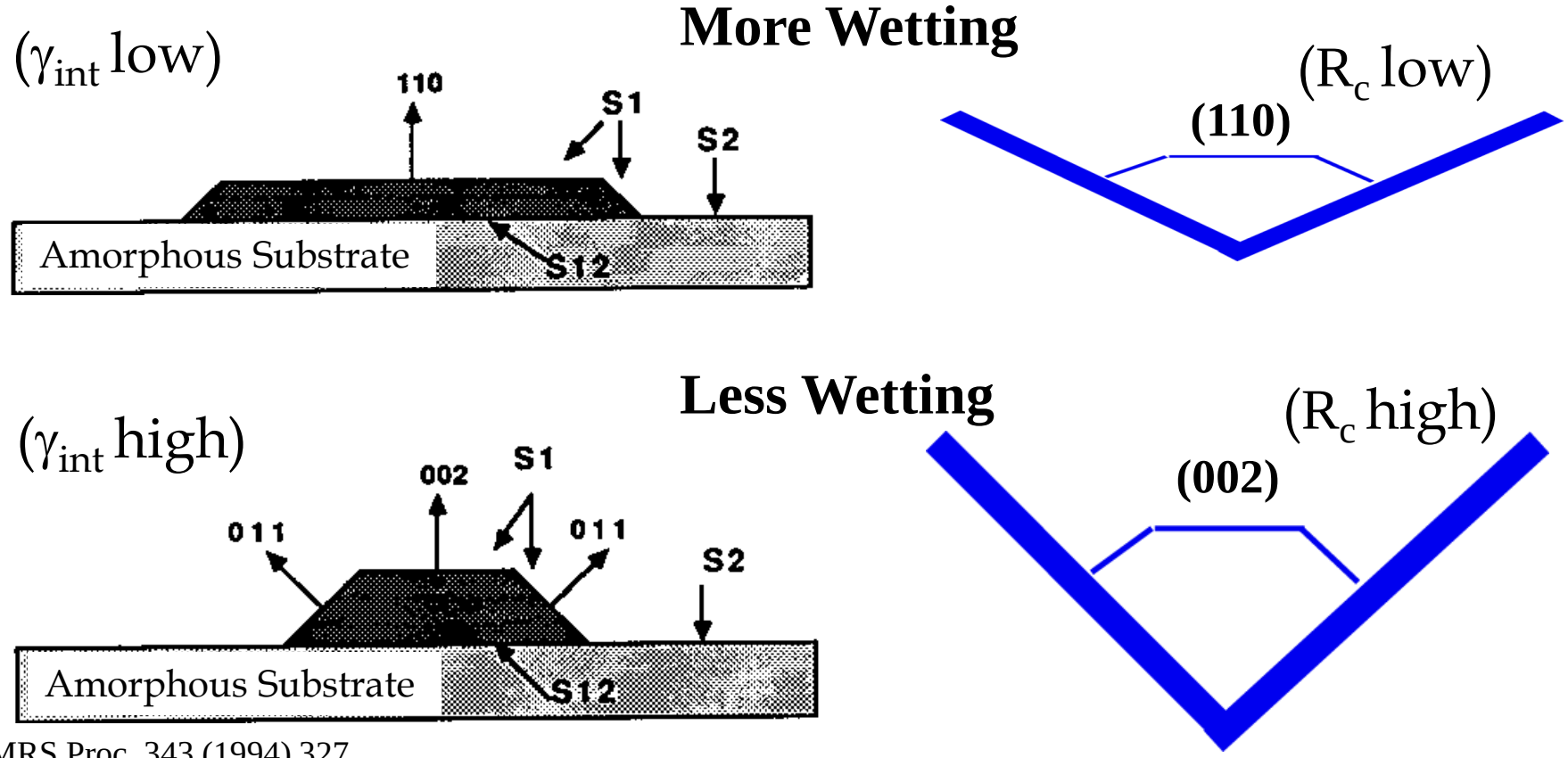



$R_c$ = .14 nm



$R_c$ = .12 nm

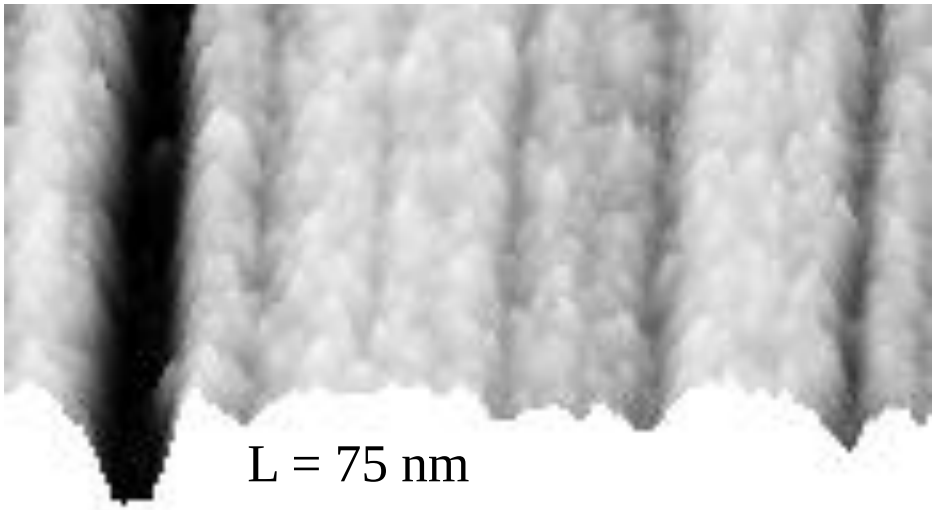
# Growth - Cr Surface Energetics




MRS Proc. 343 (1994) 327.

**Higher ($R_c$) "locks in" Cr(002) => Co(11.0) to reduce surface energy.**

# C-axis Distribution ($R_a$= 0.8, OR = 1.4)



L = 75 nm

**Circumferential**

<200> random in-plane

<200> "locked"

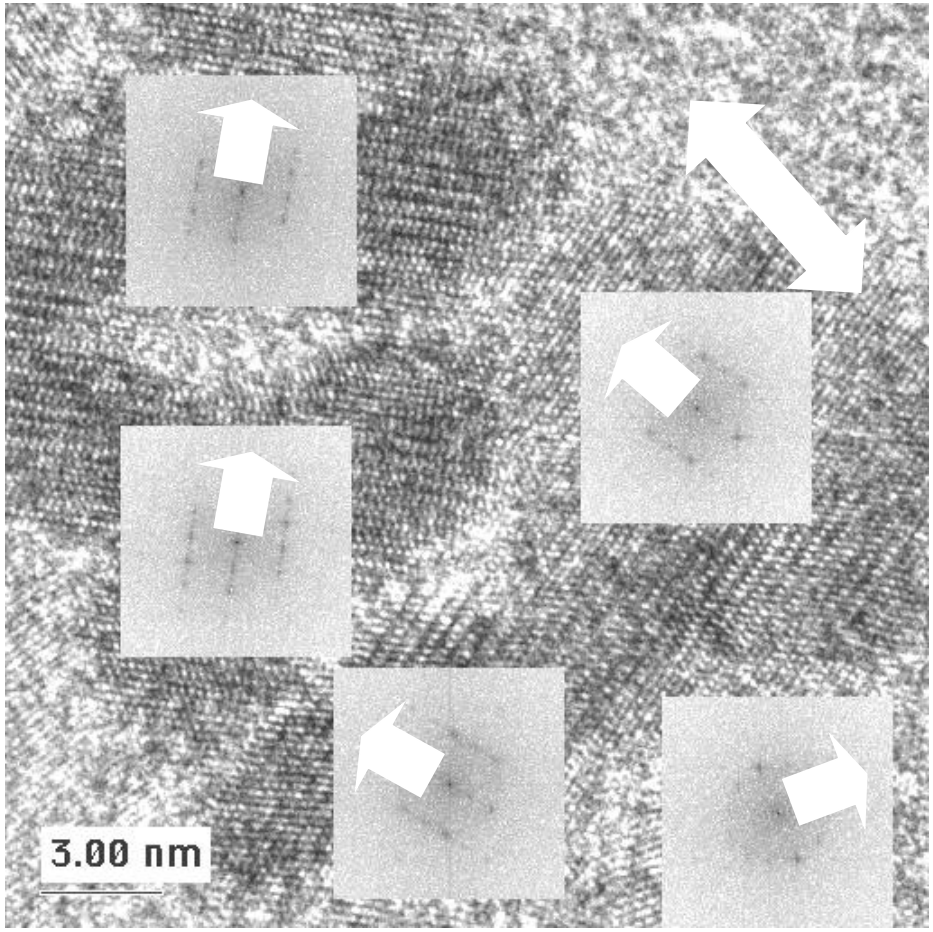
$R_a/L = 0.01$

**Radial**

[200] or [110] "locked"

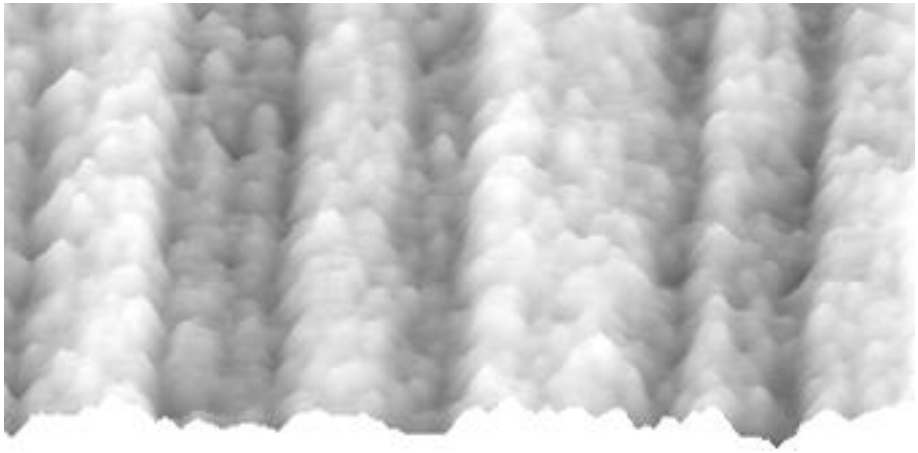
$R_c/ R_a = 0.36$

Smaller L means more <200> "locked"




c-axes **random in-plane**

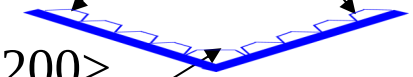
# C-axis Distribution ($R_a$= 0.4, OR = 1.7)



L = 75 nm

**Circumferential**

<200> random in-plane

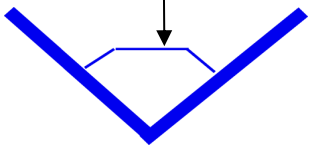


<200>
"locked"

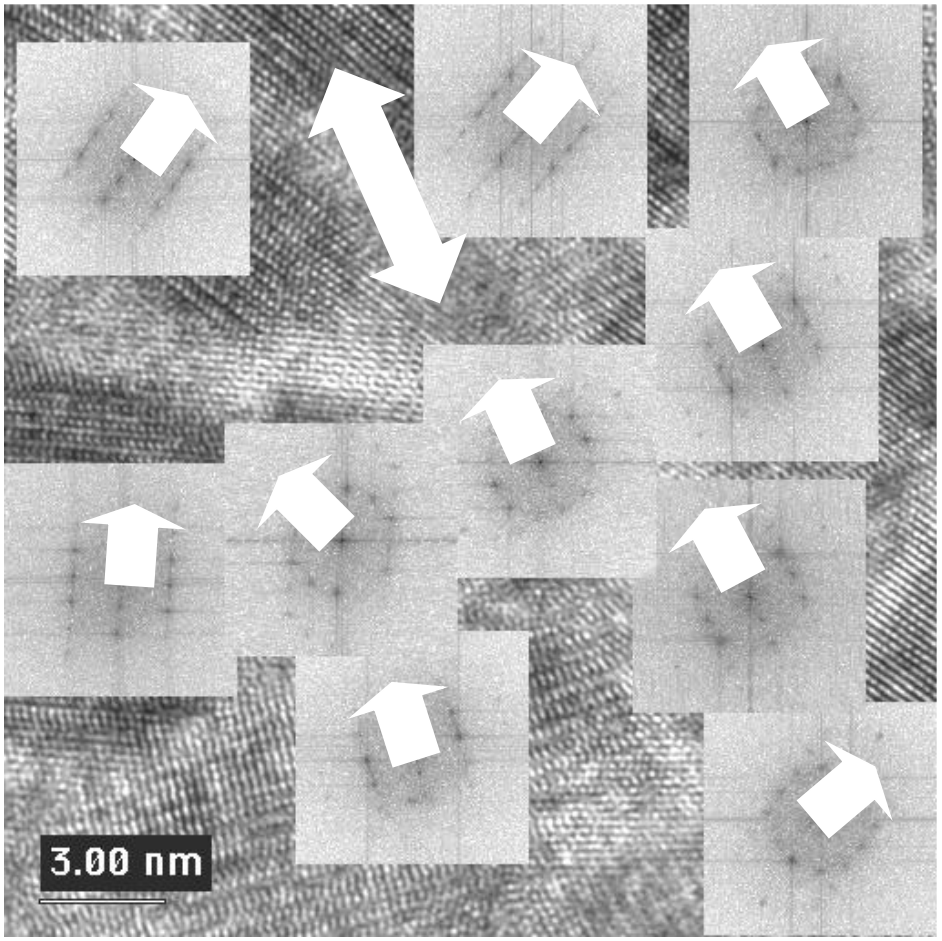
$R_a/L = 0.005$

**Radial**

[200]
"locked"



$R_c/ R_a = 0.42$




c-axes **aligned in-plane**

# Summary

- 2D $R_a$ alone is not sufficient to describe "smooth" ($R_a$ < 0.4 nm) surfaces
  - "Line Density" too arbitrary a metric
    - Suffers from poor counting statistics (~10's)
      - Does not explain *c-axis* alignment
- $R_c$ more completely characterizes texture
  - Better sampling statistics (~100's)
  - Gauges tendency towards *c-axis* alignment

# *Challenges*

- Distinguishing disks with $\Delta$ OR less than $\leq 0.1$
- Characterizing “ultrasmooth” ($R_a < 0.3$ nm) surfaces
- =>May require higher **resolution** (not magnification) imaging and/or fractal dimensioning