

# SEM analysis of HDS accelerating structures from recent 30 GHz tests at CTF3.

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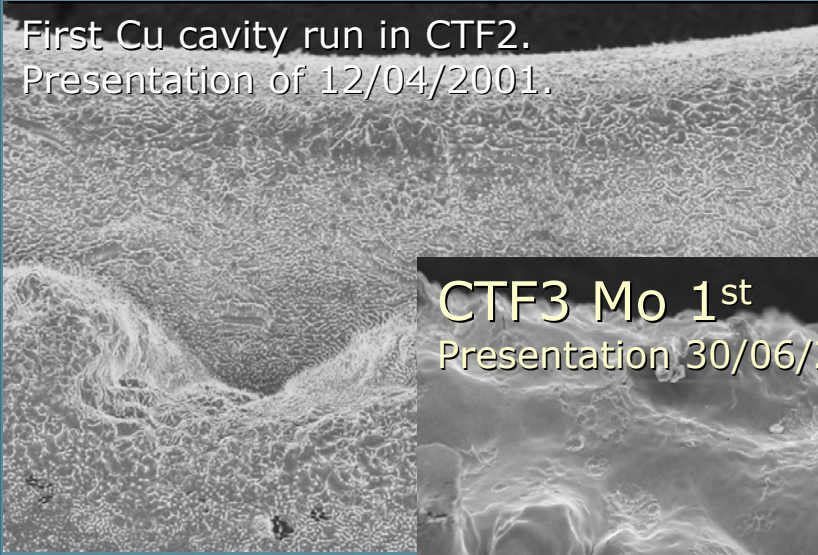
# Contents.

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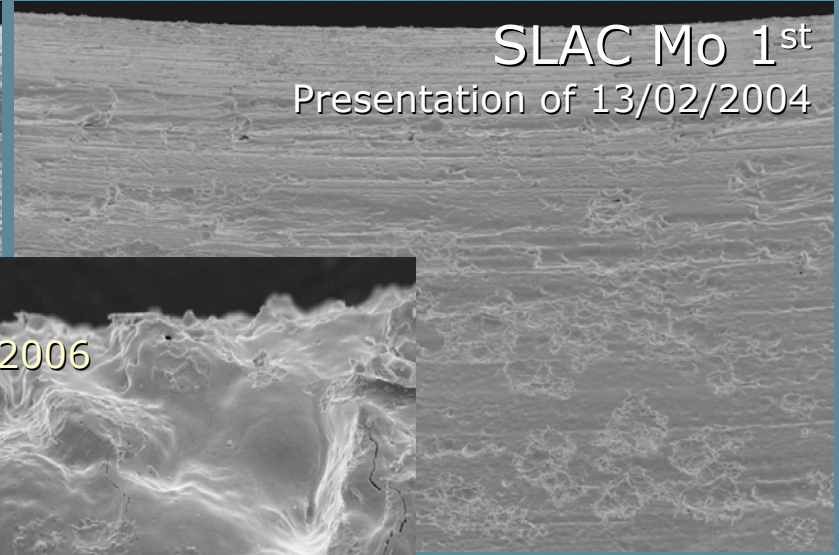
- Old for memory and remarks.
- HDS60 Cu
- HDS60 Cu small
- HDS11 Mo
- HDS11 Ti
- Cross comparisons and comments

# Reminder of old images of **disc** structures. Flat views x200.

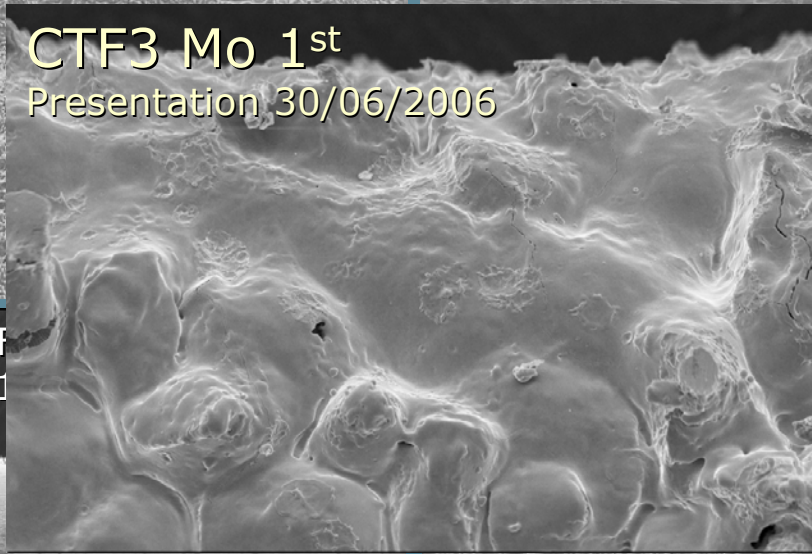
First Cu cavity run in CTF2.  
Presentation of 12/04/2001.



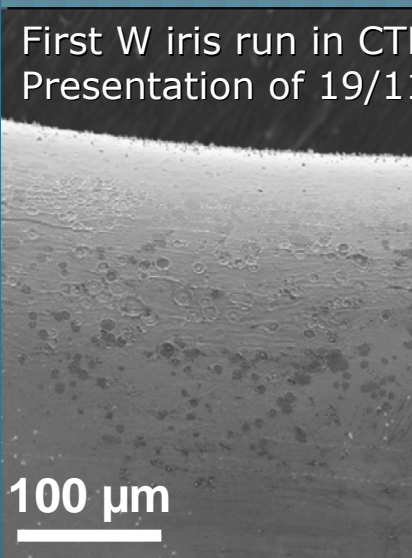
SLAC Mo 1<sup>st</sup>  
Presentation of 13/02/2004



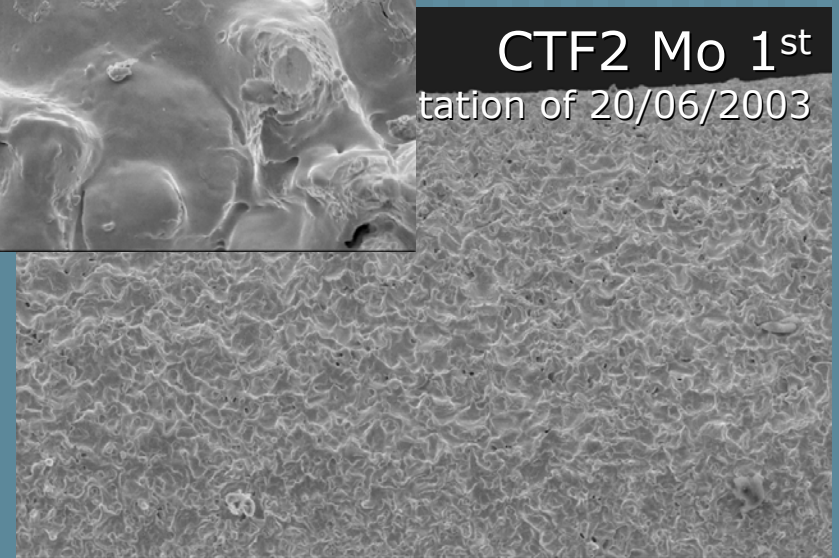
CTF3 Mo 1<sup>st</sup>  
Presentation 30/06/2006



First W iris run in CTF  
Presentation of 19/11



CTF2 Mo 1<sup>st</sup>  
tation of 20/06/2003



200x 100 μm

# Remarks on how images are taken.

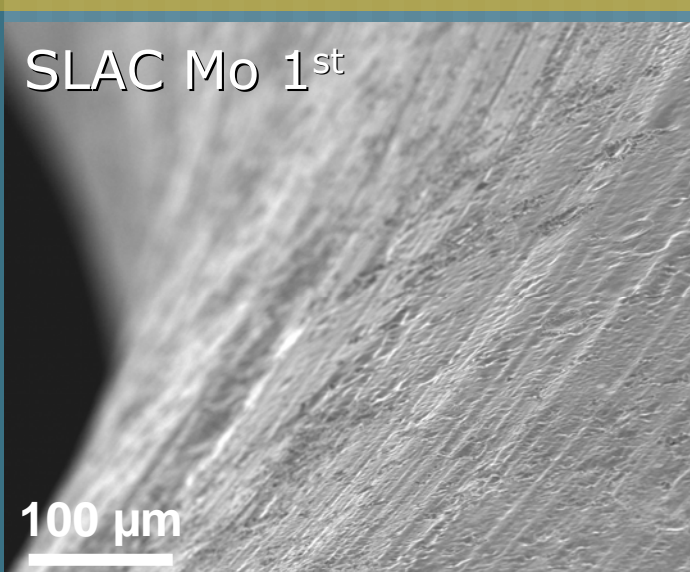
- That kind of flat views is not possible any more without cutting the HDS structures
  - ⇒ Side tilted view of the iris flat
  - ⇒ Frontal view of the iris thickness
- Convenient positioning and tilting in the microscope chamber is particularly limited for the large HDS60 Cu.
- Set of magnifications used:

50x	<u>400 μm</u>
200x	<u>100 μm</u>
1000x	<u>20 μm</u>

# Reminder of old images of **disc** structures. Side tilted views x200.

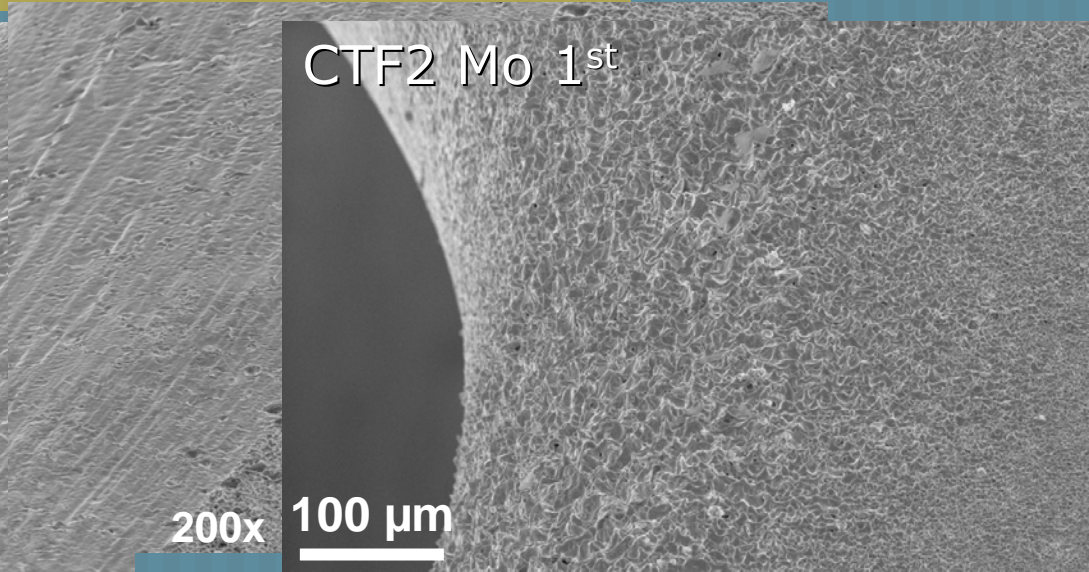
SLAC Mo 1<sup>st</sup>

200x 100  $\mu\text{m}$



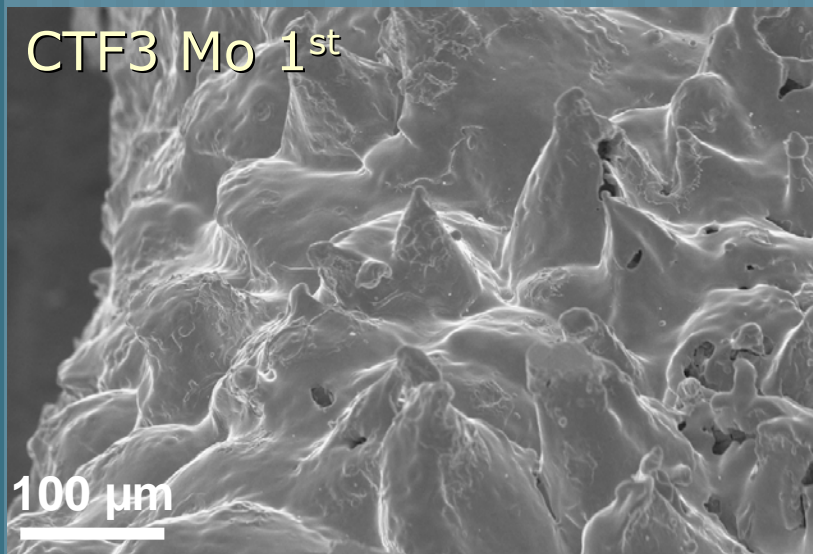
CTF2 Mo 1<sup>st</sup>

200x 100  $\mu\text{m}$



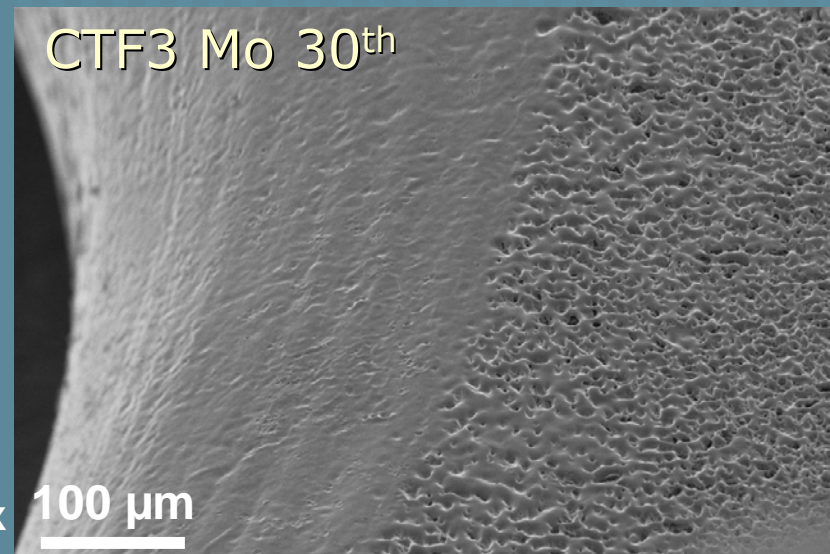
CTF3 Mo 1<sup>st</sup>

200x 100  $\mu\text{m}$

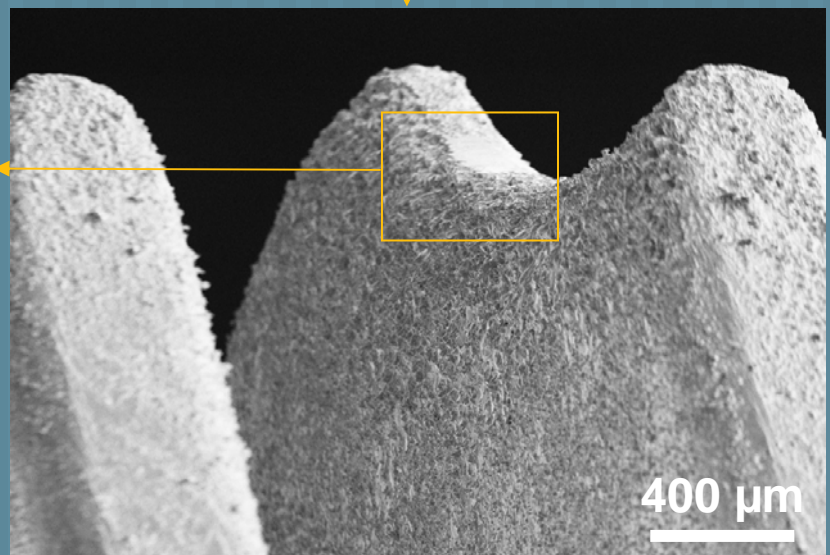
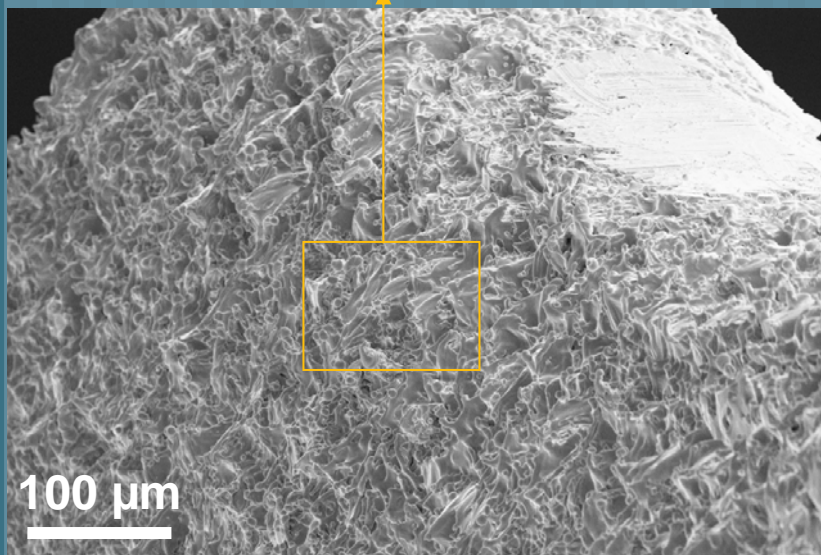
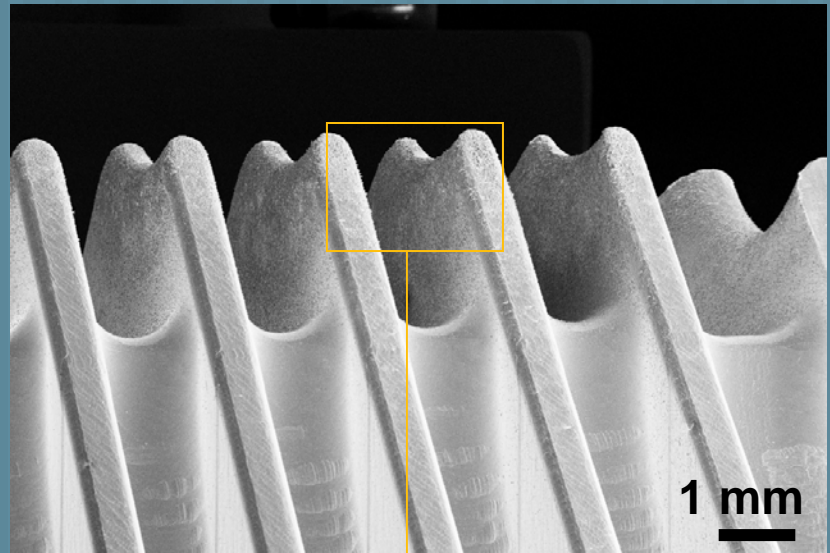
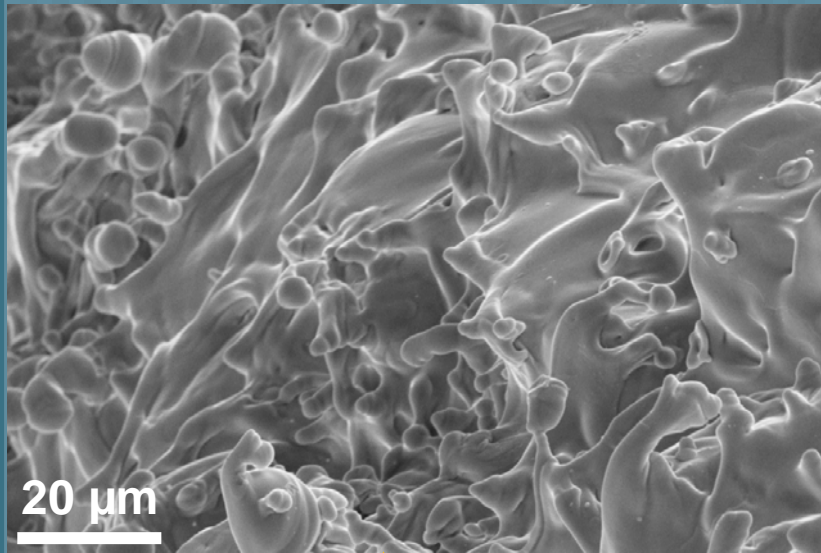


CTF3 Mo 30<sup>th</sup>

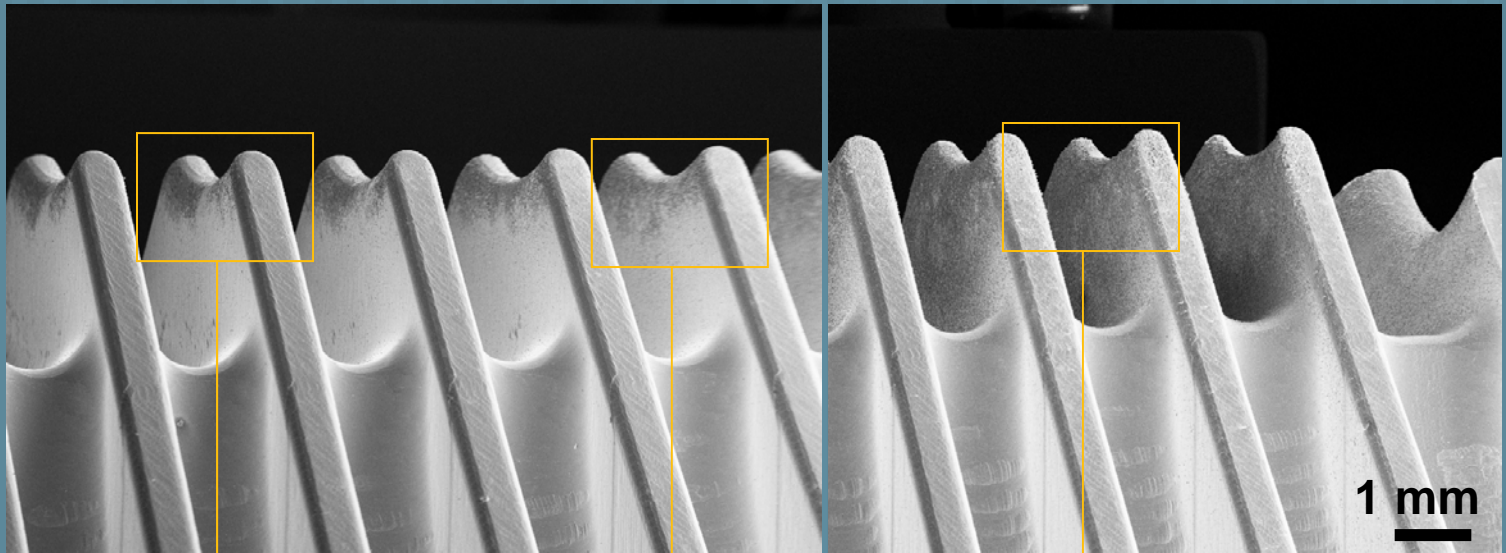
200x 100  $\mu\text{m}$



# HDS 60 Cu

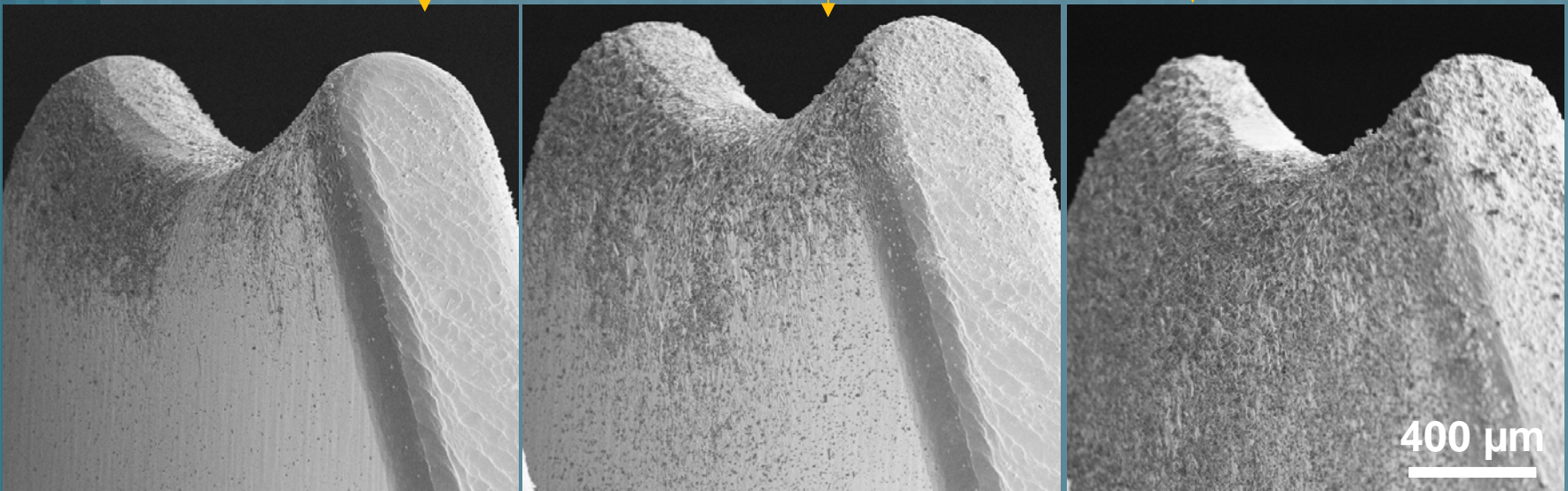


# HDS 60 Cu



1 mm

11x



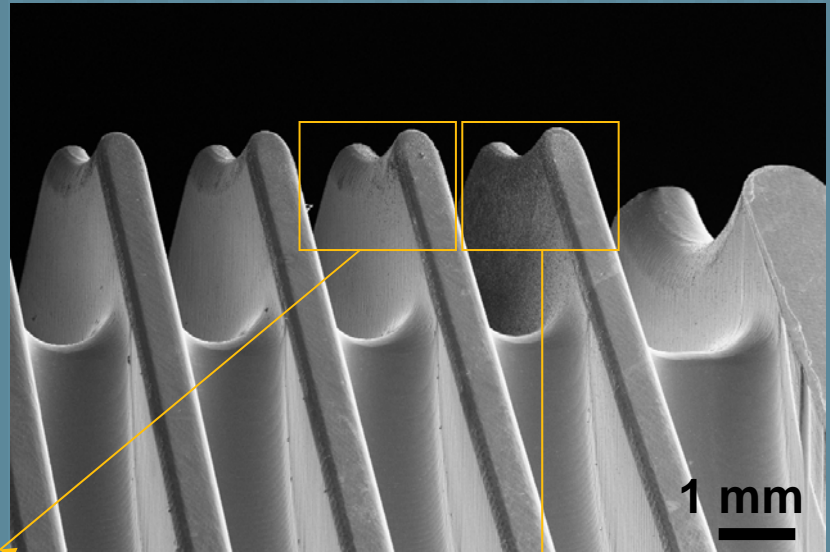
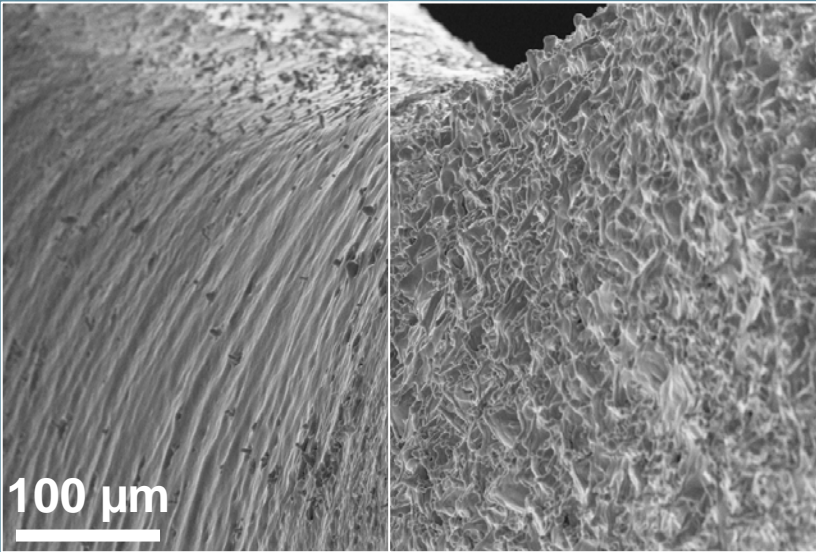
400 μm

50x

# HDS 60 Cu small

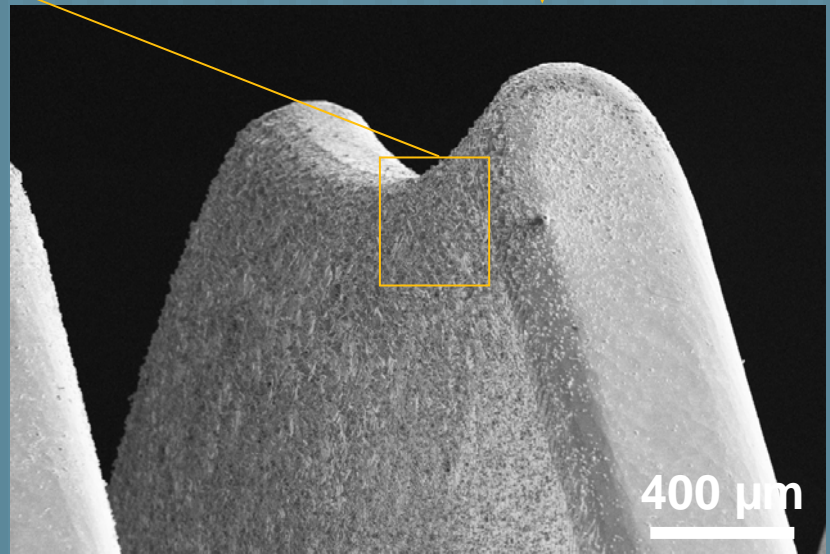
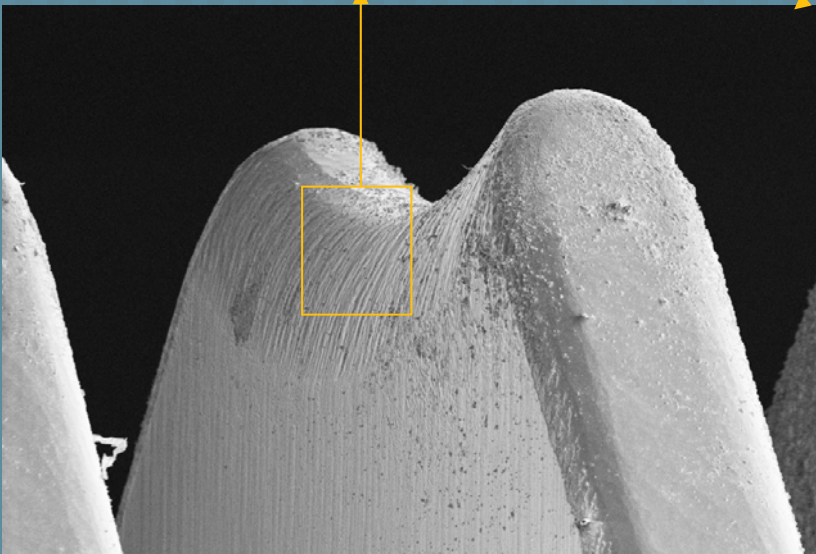
200x

100  $\mu\text{m}$



11x

1 mm



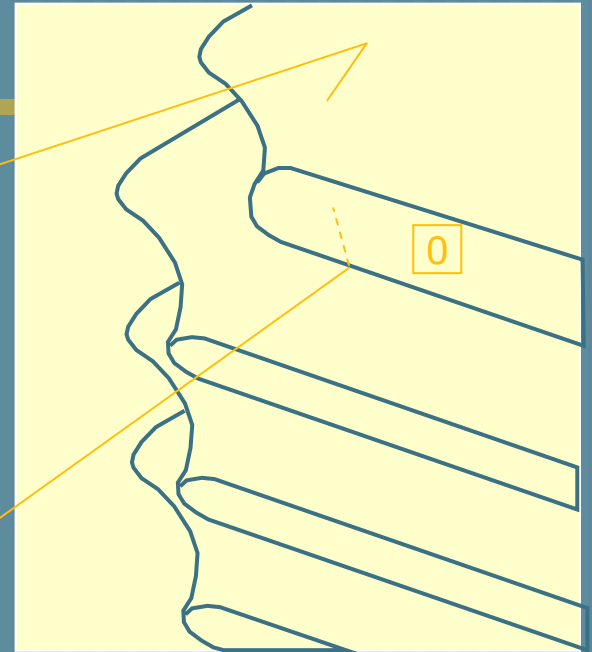
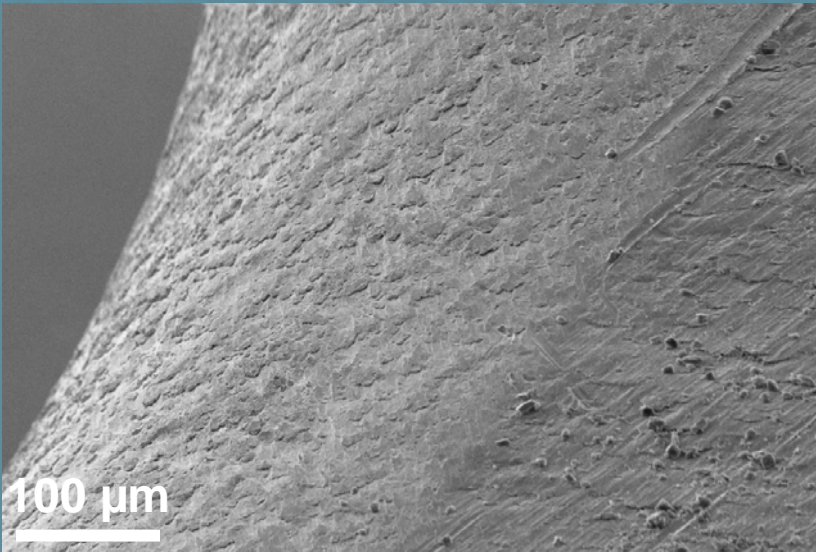
50x

400  $\mu\text{m}$

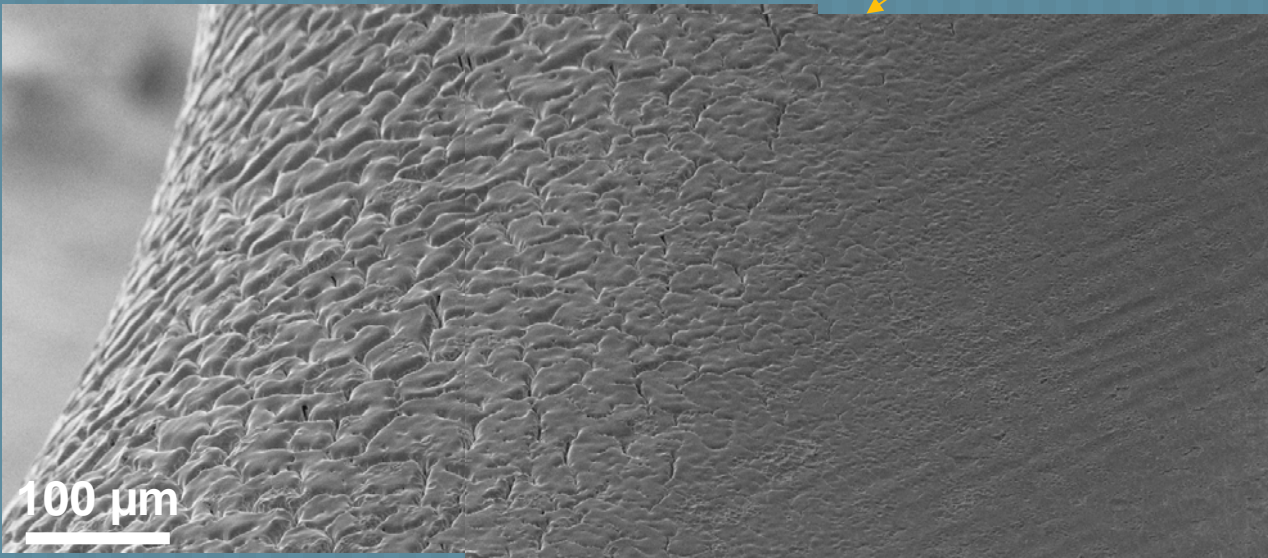


# HDS 11 Mo

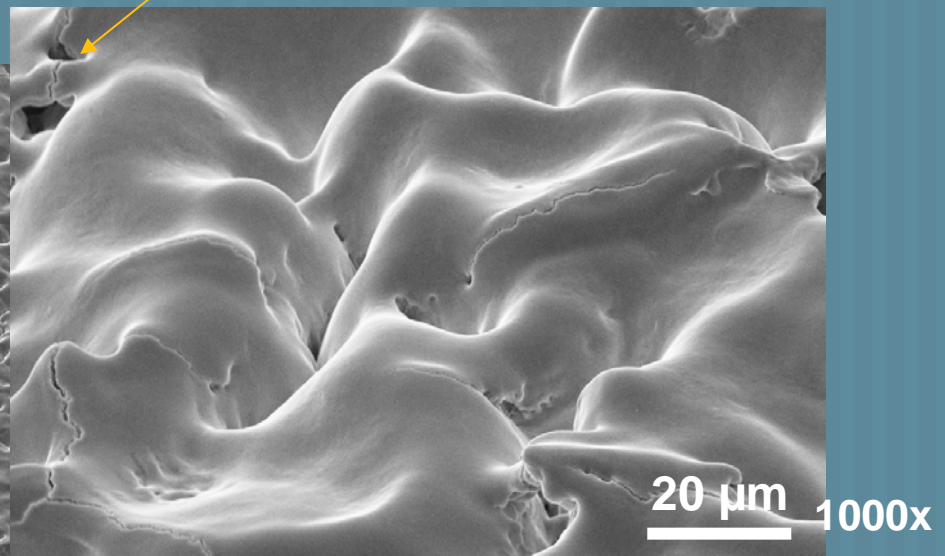
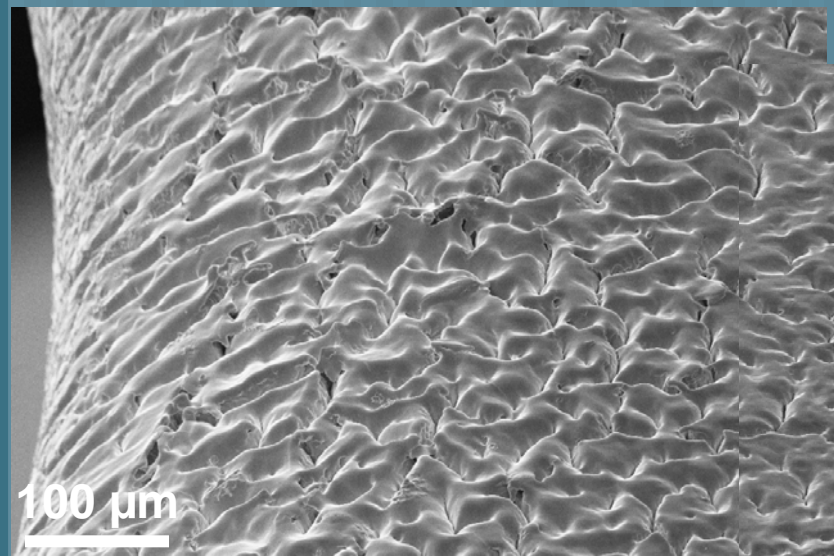
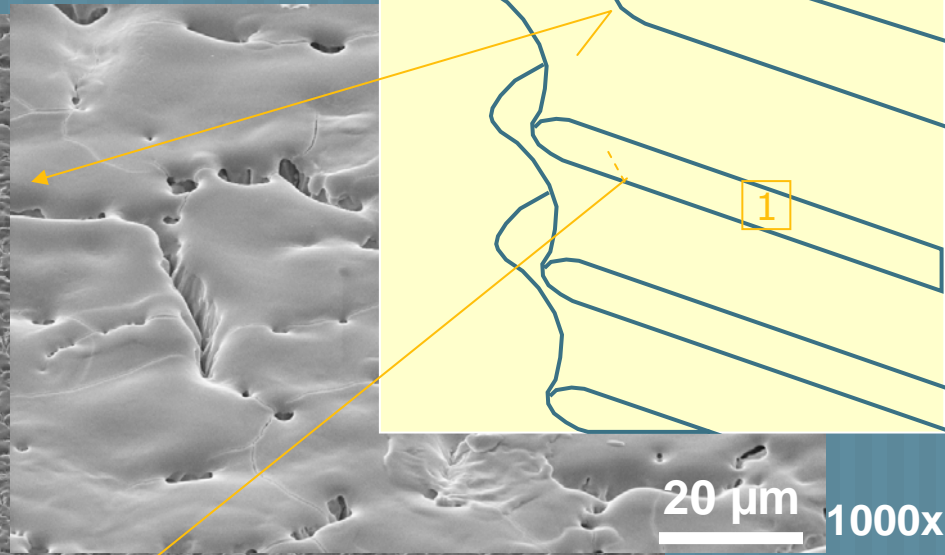
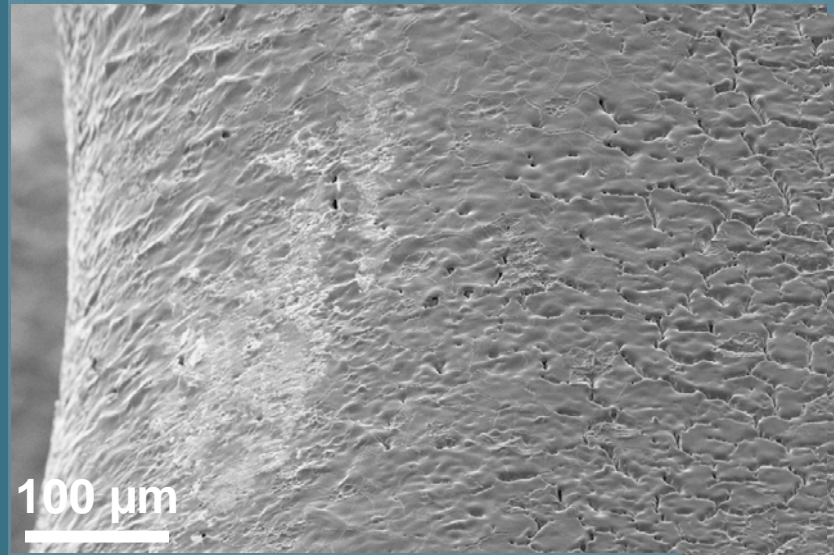
200x 100  $\mu\text{m}$



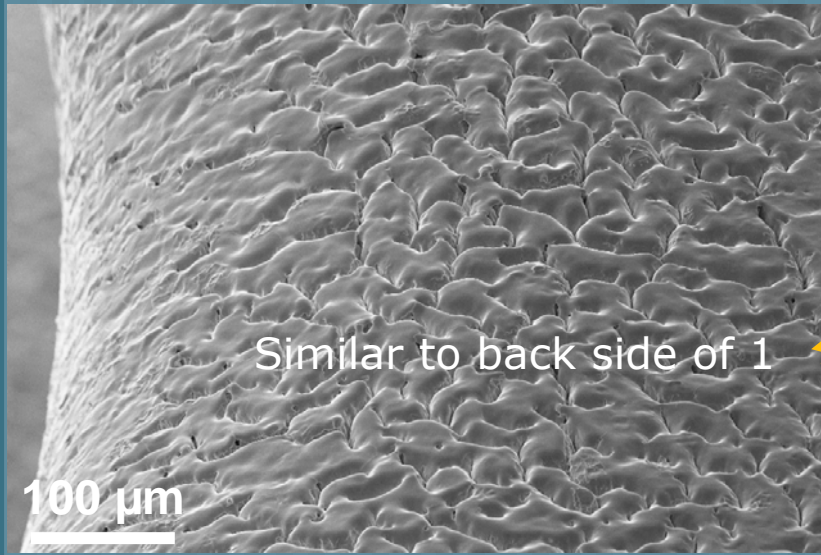
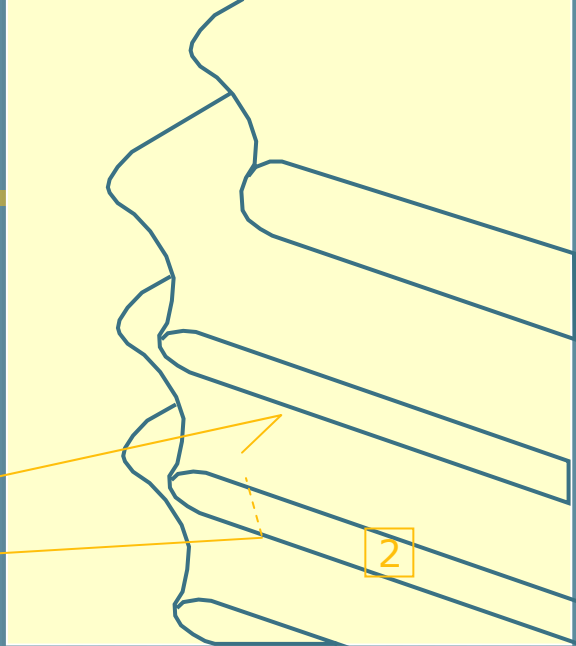
200x 100  $\mu\text{m}$



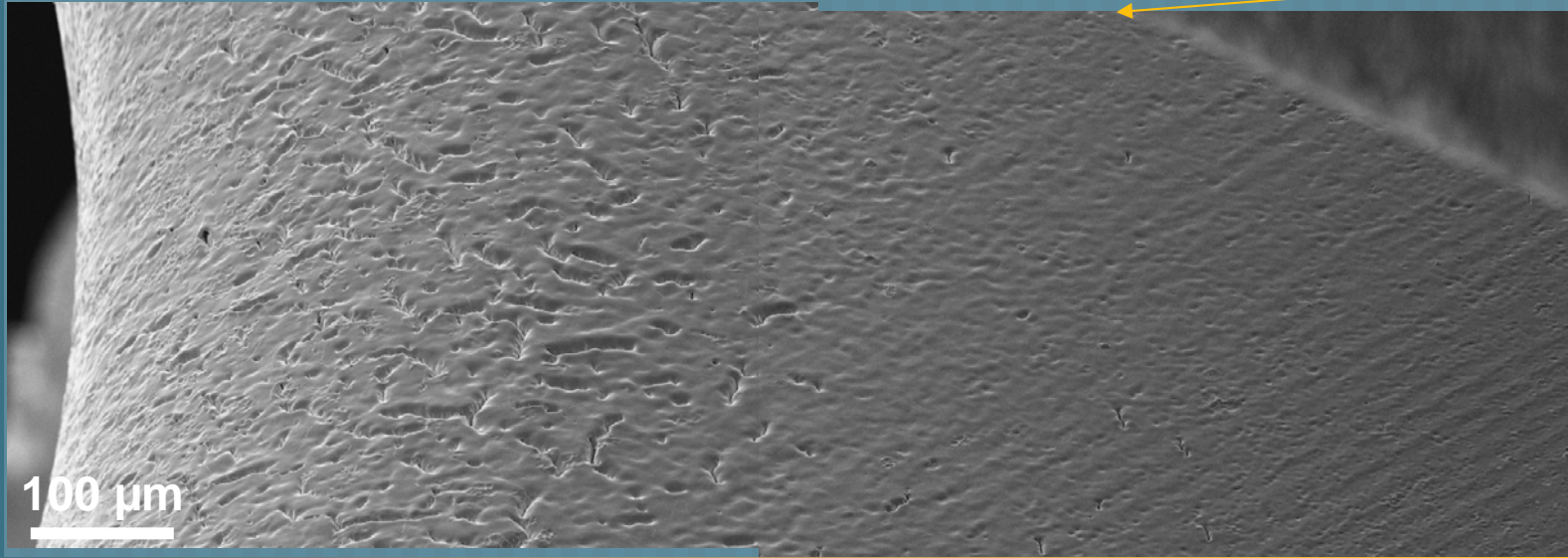
# HDS 11 Mo



# HDS 11 Mo



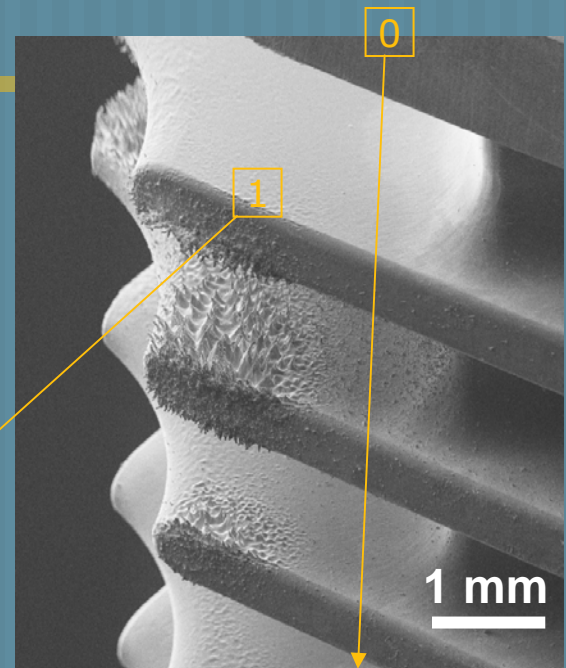
... 12



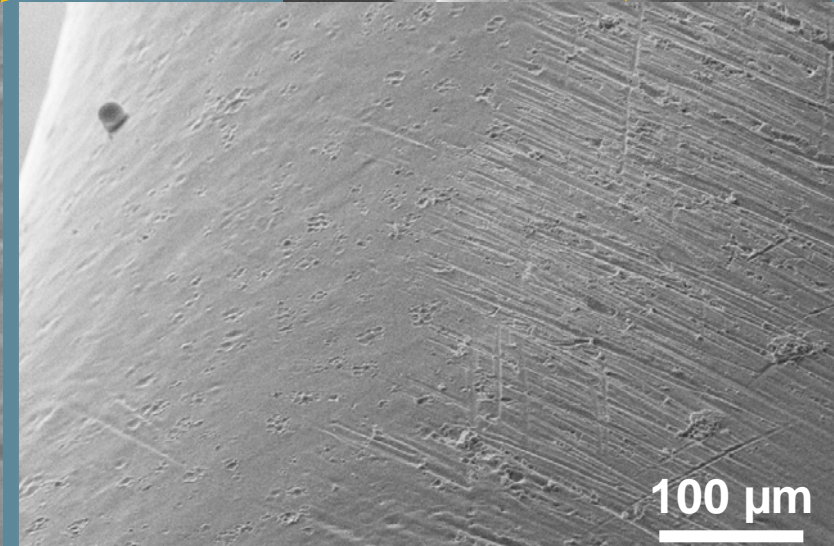
# HDS 11 Ti

Reference, before test

200x 100  $\mu\text{m}$

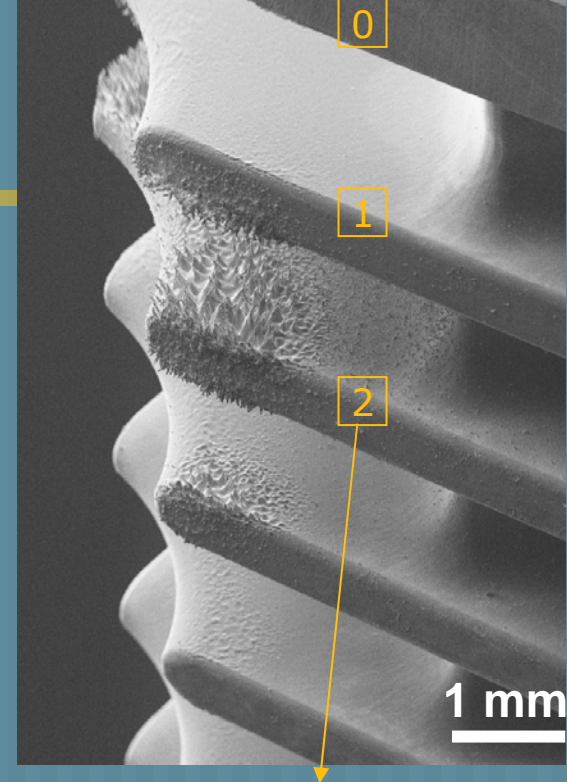


200x 100  $\mu\text{m}$

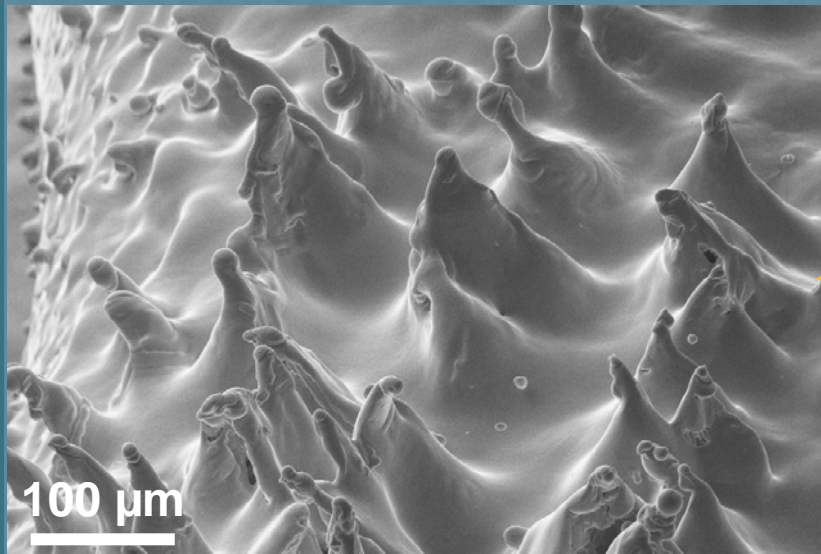


200x

# HDS 11 Ti

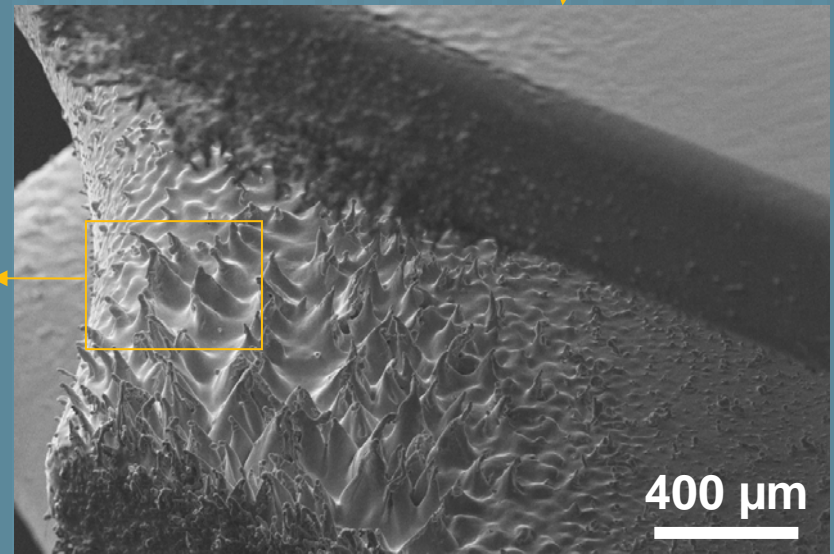


16x



200x

100 μm

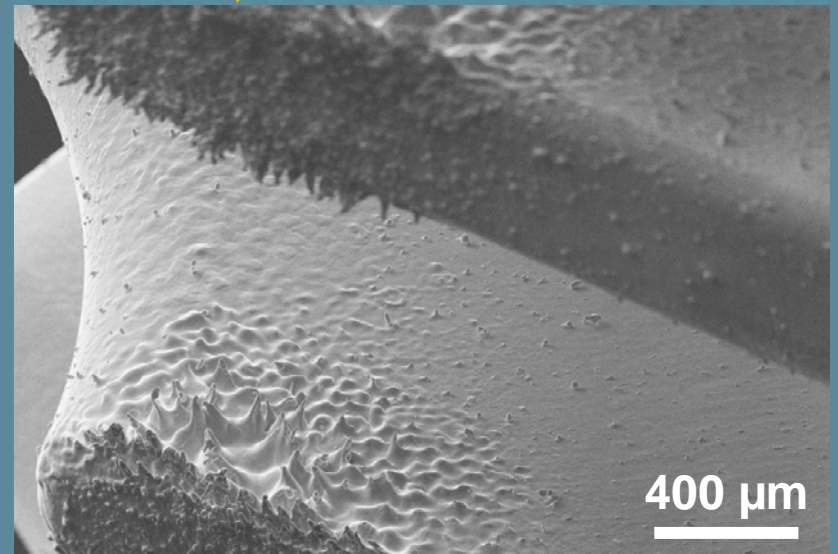
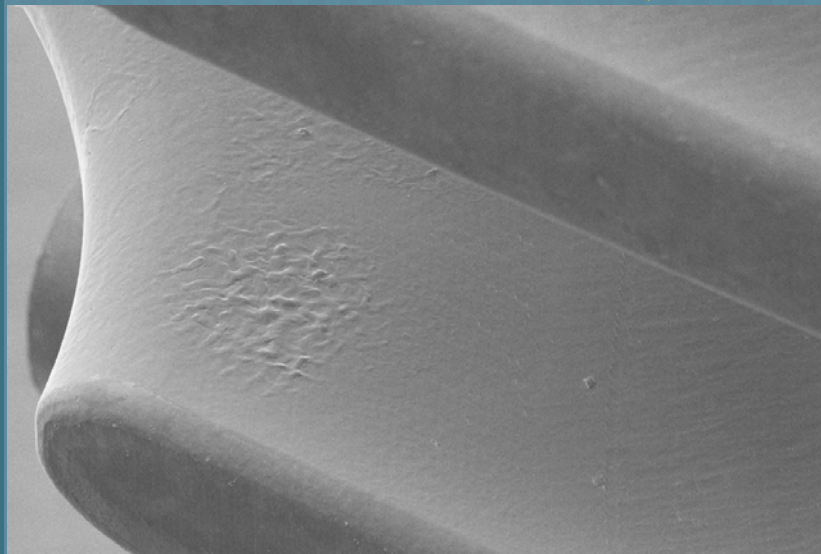
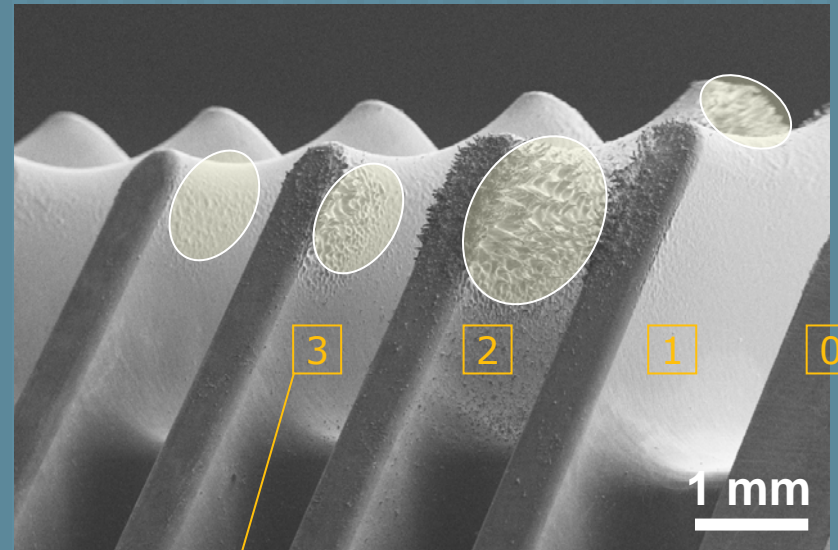


50x

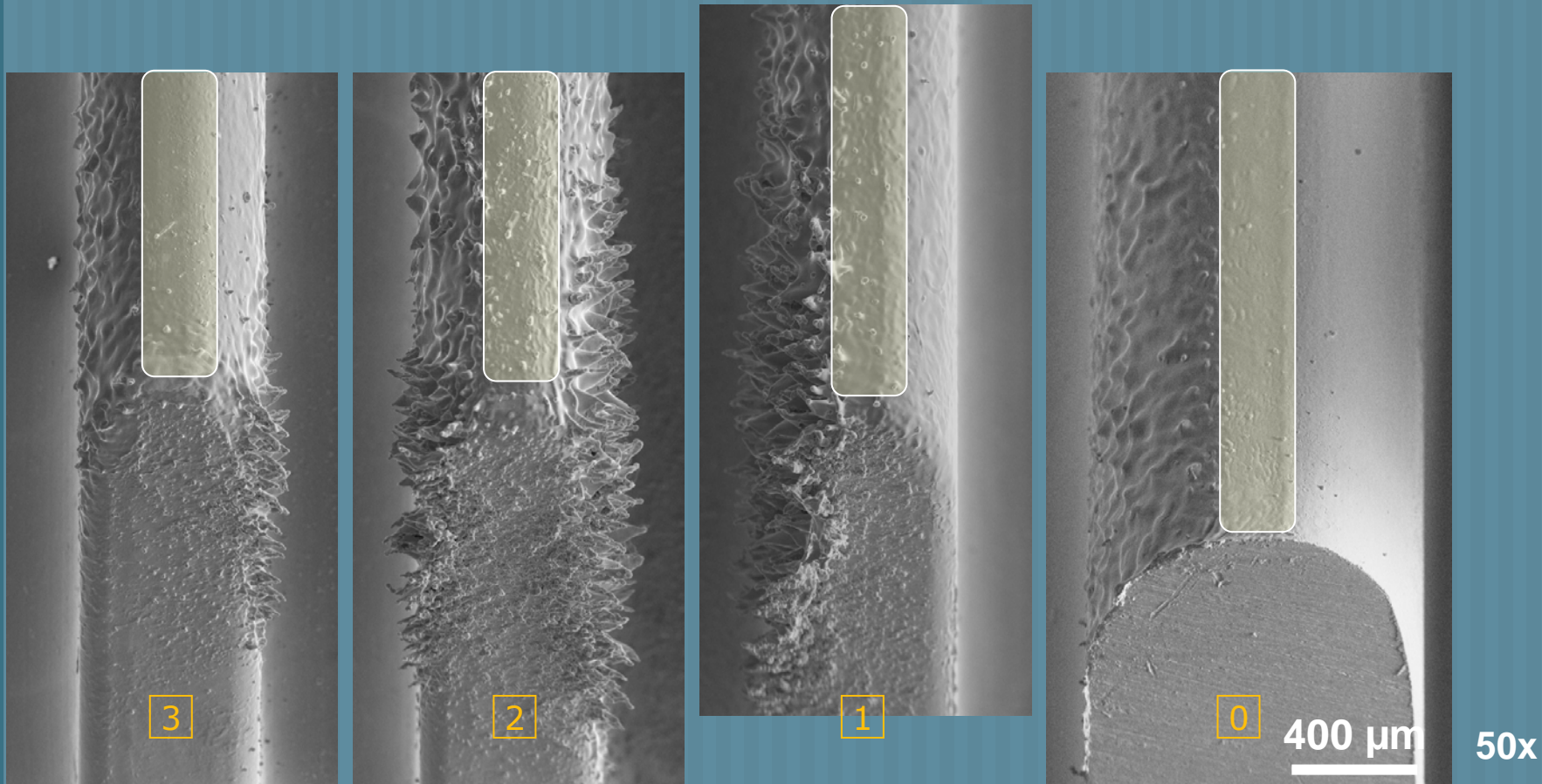
400 μm

# HDS 11 Ti

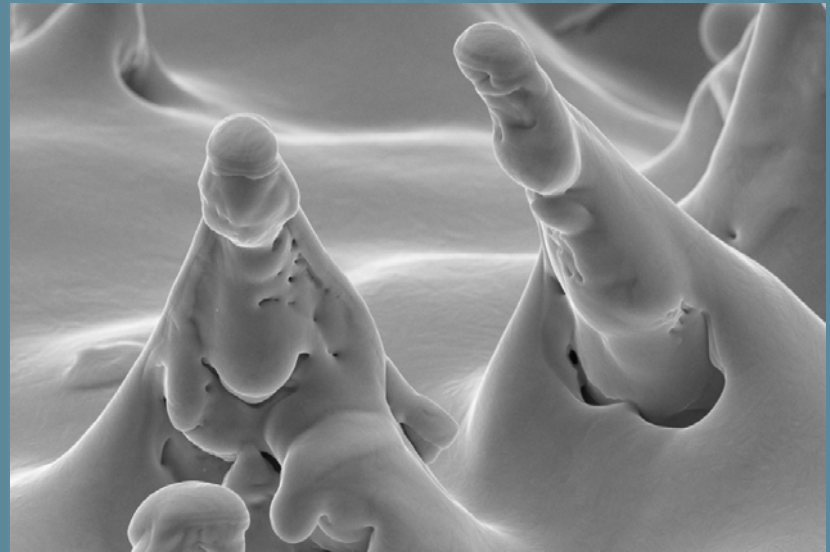
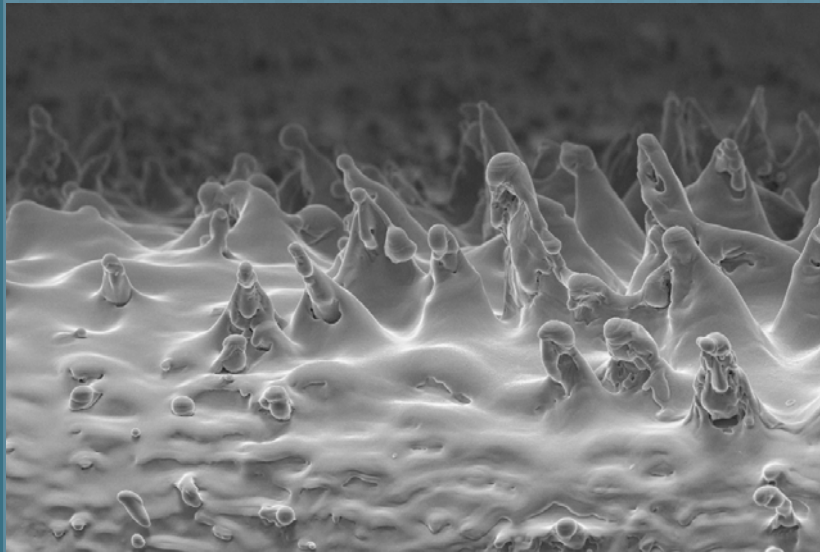
12 ...



# HDS 11 Ti



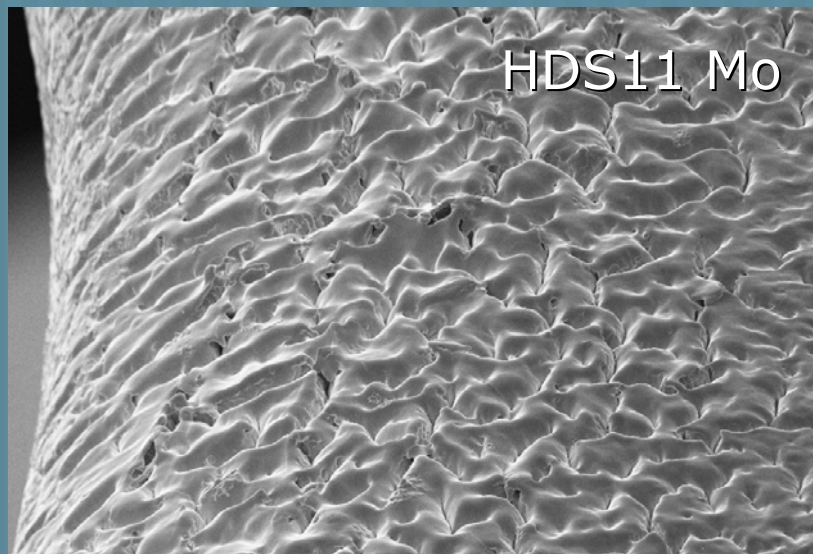
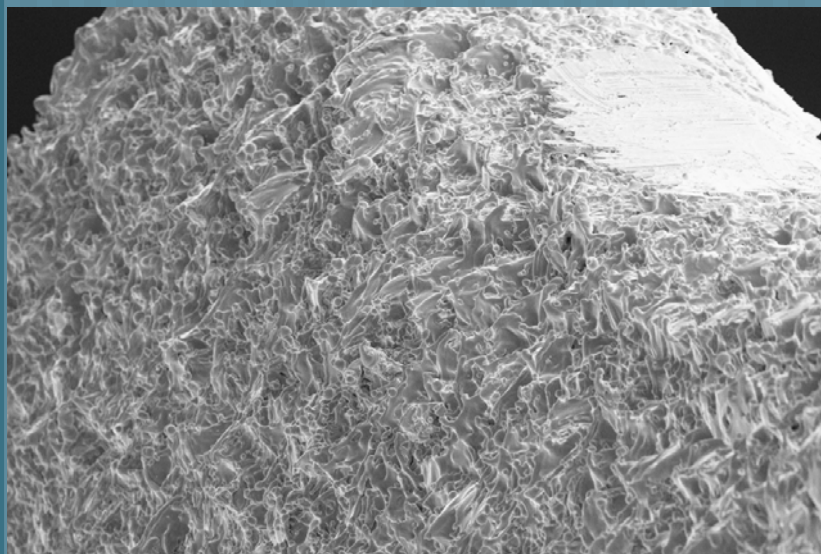
# HDS 11 Ti



Cones seem to grow by repeated pulling of liquid.



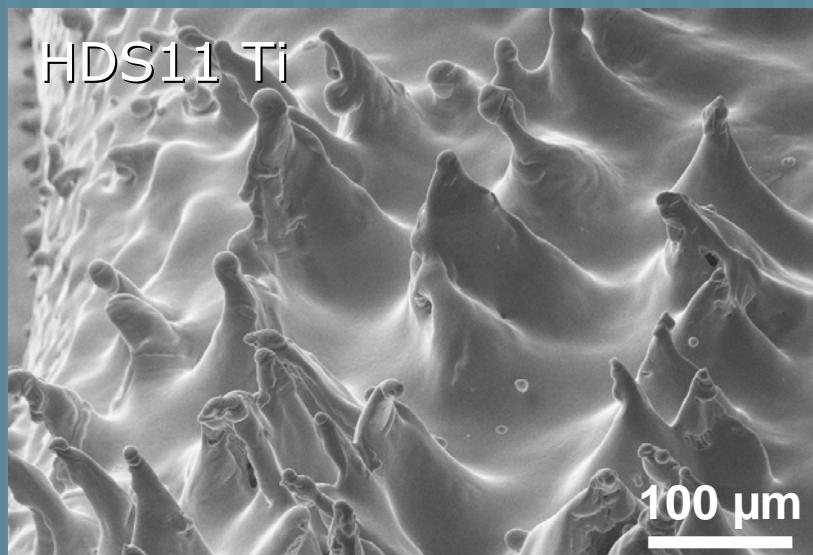
# Cross comparison HDS



Growth of structures by **pulling of liquid** seems to happen in worst regions of **HDS60 Cu** and **HDS11 Ti** but is not evident in HDS11 Mo.

Intense damage features are most **oriented an high** in **HDS11 Ti** but they are also **less widespread**.

Only **HDS11 Mo** presents **cracks** (lower ductility, higher  $\Delta T$  from solidification to room temperature?)

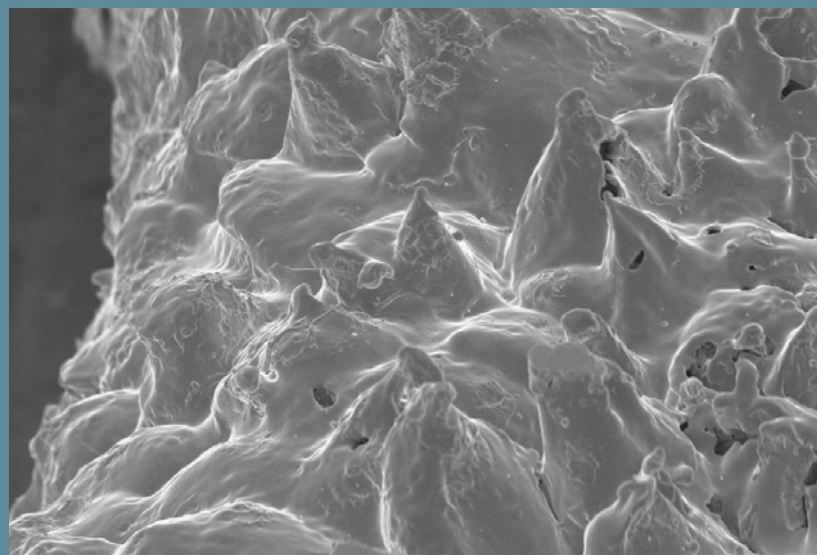
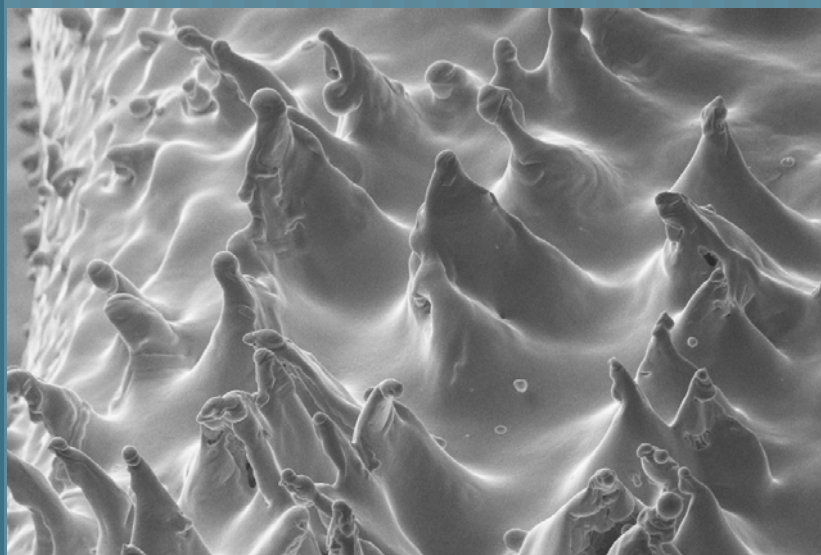
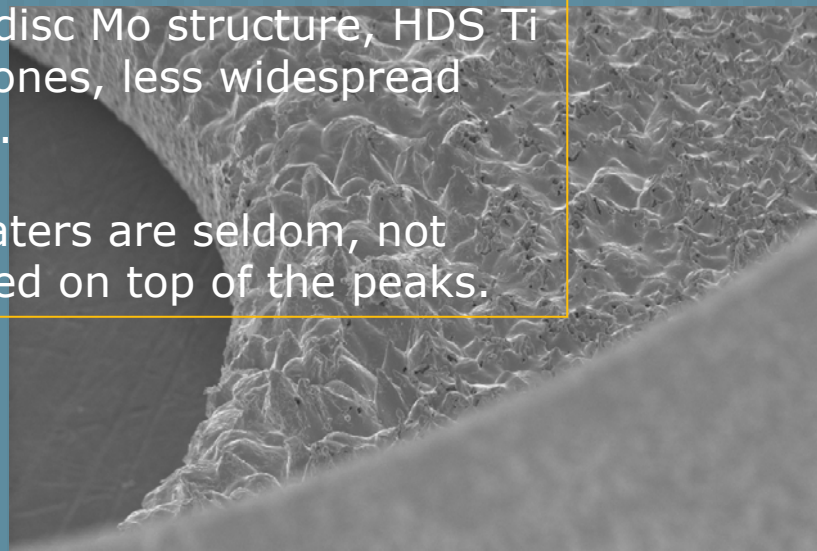


# Comparison of cones in HDS11 Ti and Mo disc structure.



Compared to disc Mo structure, HDS Ti has sharper cones, less widespread and no cracks.

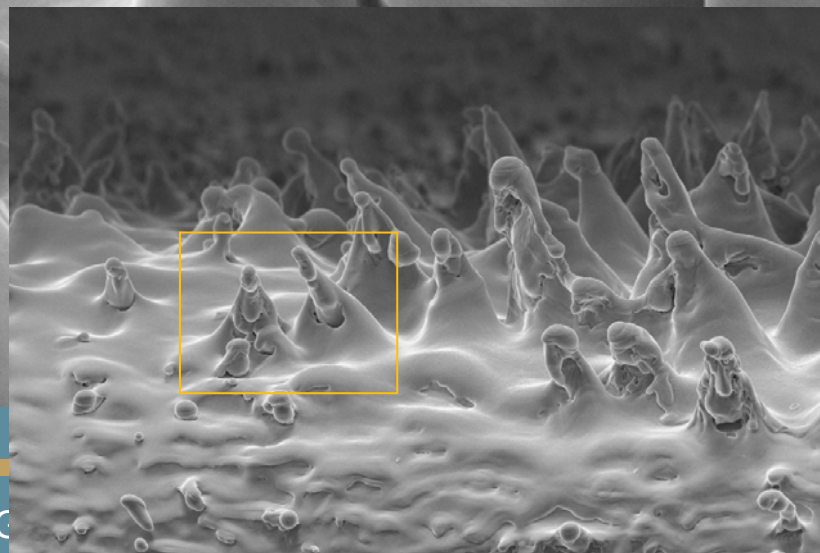
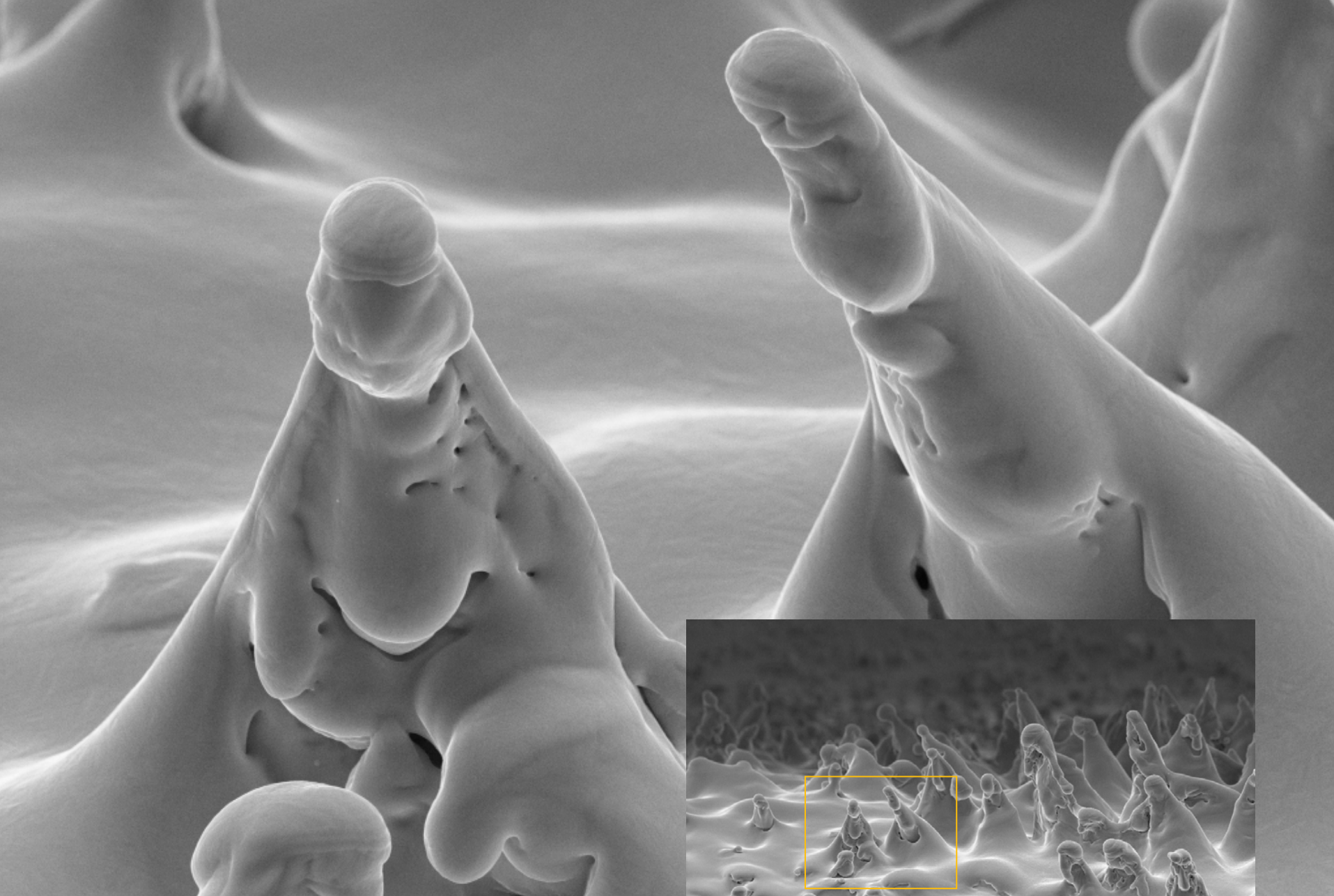
Clusters of craters are seldom, not always localized on top of the peaks.

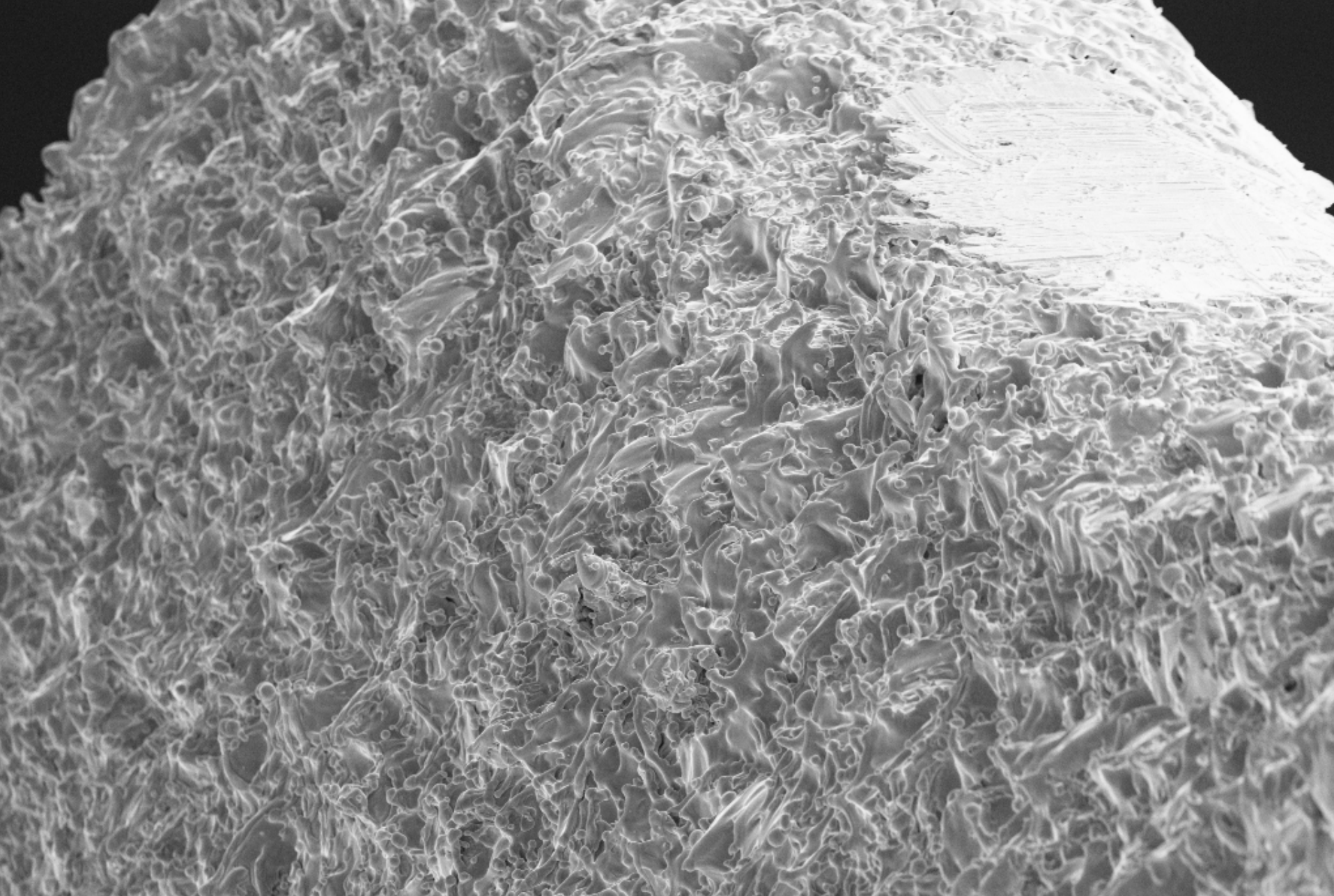


# Conclusion

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- Damage features observed:
  - Extensive smoothening
  - Pattern of cracks (fragility of refractories)
  - Sharp cones
  - Clusters of craters (breakdown)
  - Projections droplets.
- All were known but the mechanisms of formation remain not completely understood.
- Their extension and distribution have been observed.





Mag = 200 X  
EHT = 20.00 kV  
Detector = SE1

100µm

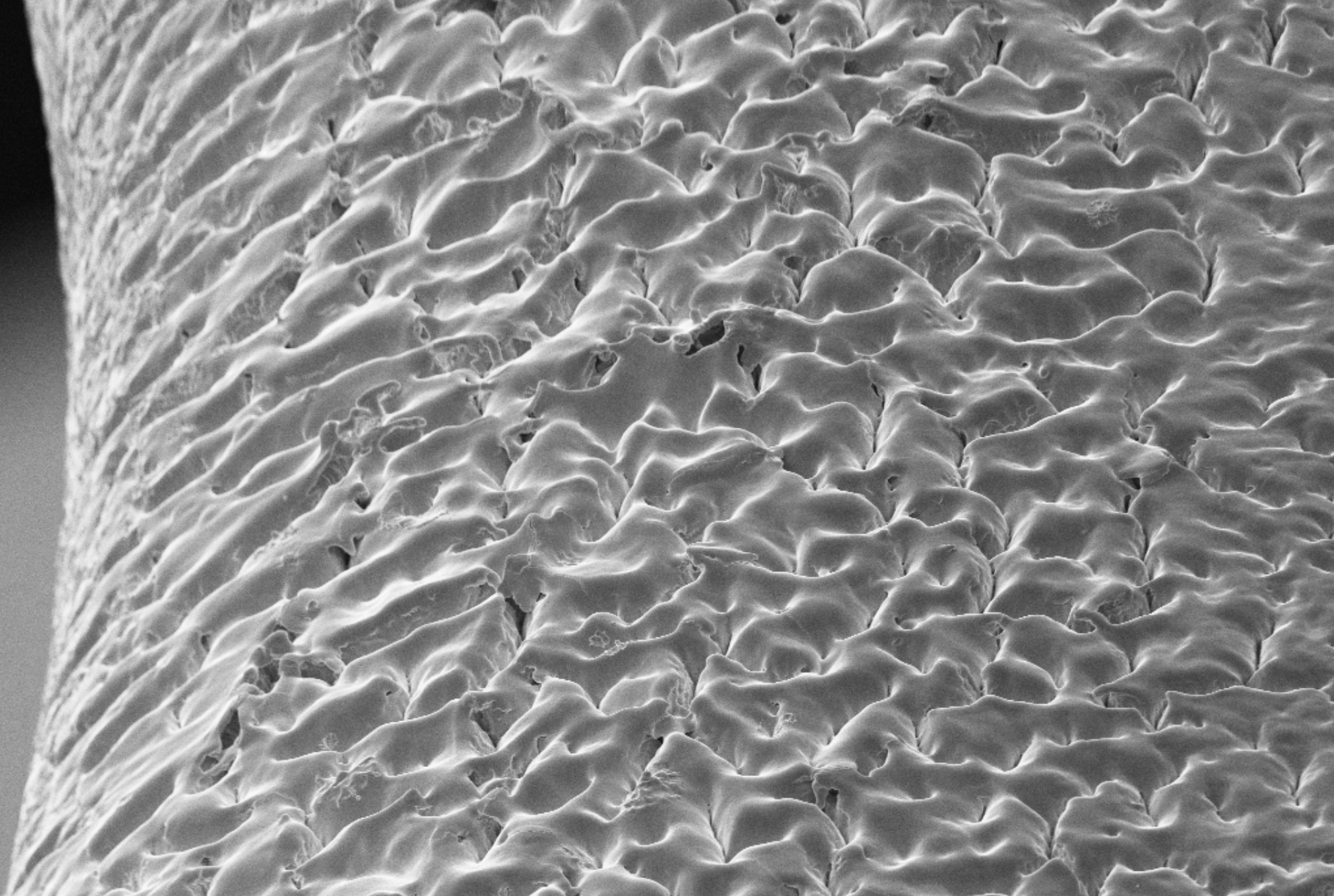


HDS60Cu, iris 2, 18°

File Name = HDS60Cu-11.tif

Date :11 Jan 2007

G. Arnau TS/MME



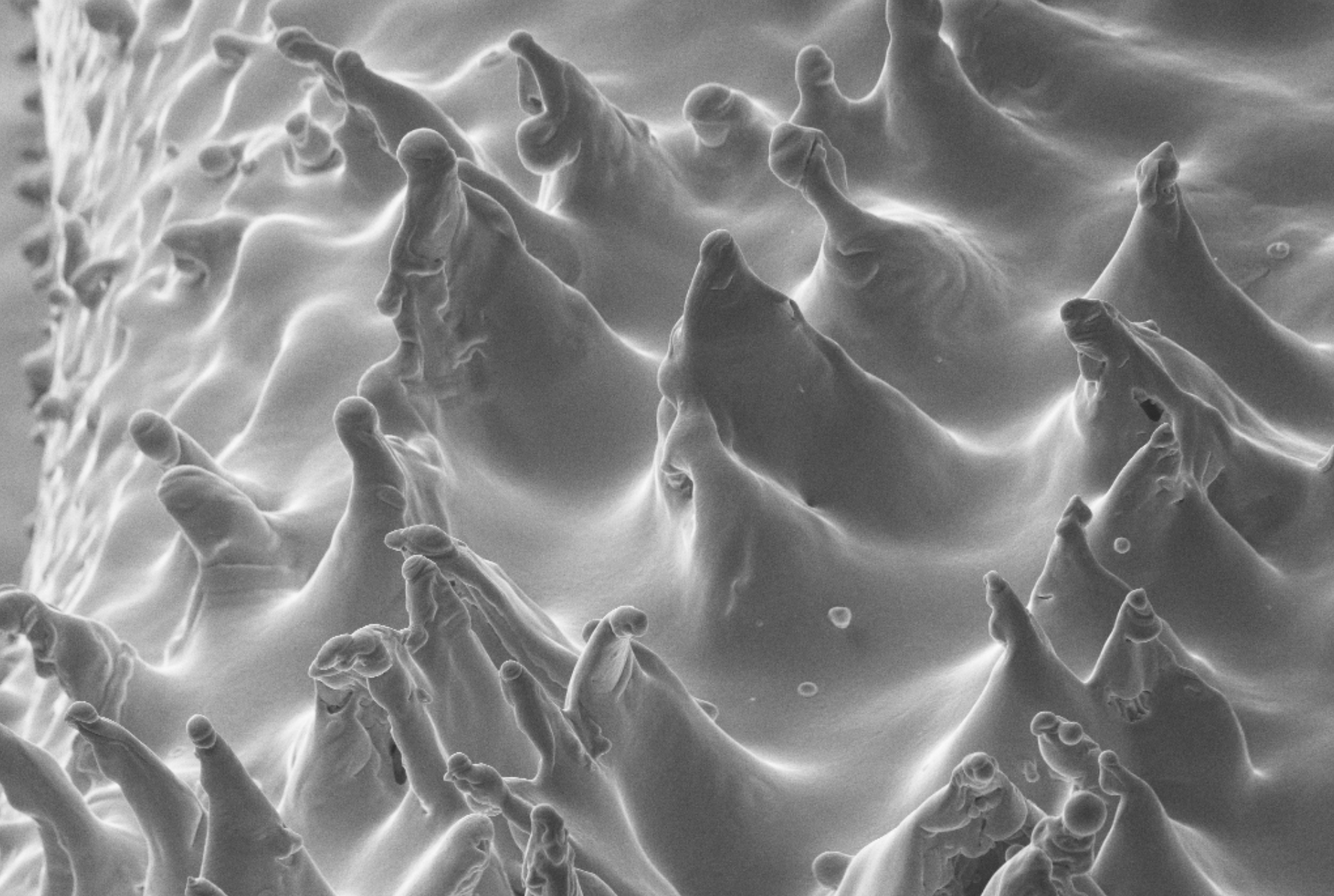
Mag = 200 X  
EHT = 20.00 kV  
Detector = SE1

100µm



HDS11Mo, iris +1, 55°

File Name = HDS11Mo-66.tif  
Date :12 Oct 2006  
G. Arnau TS/MME



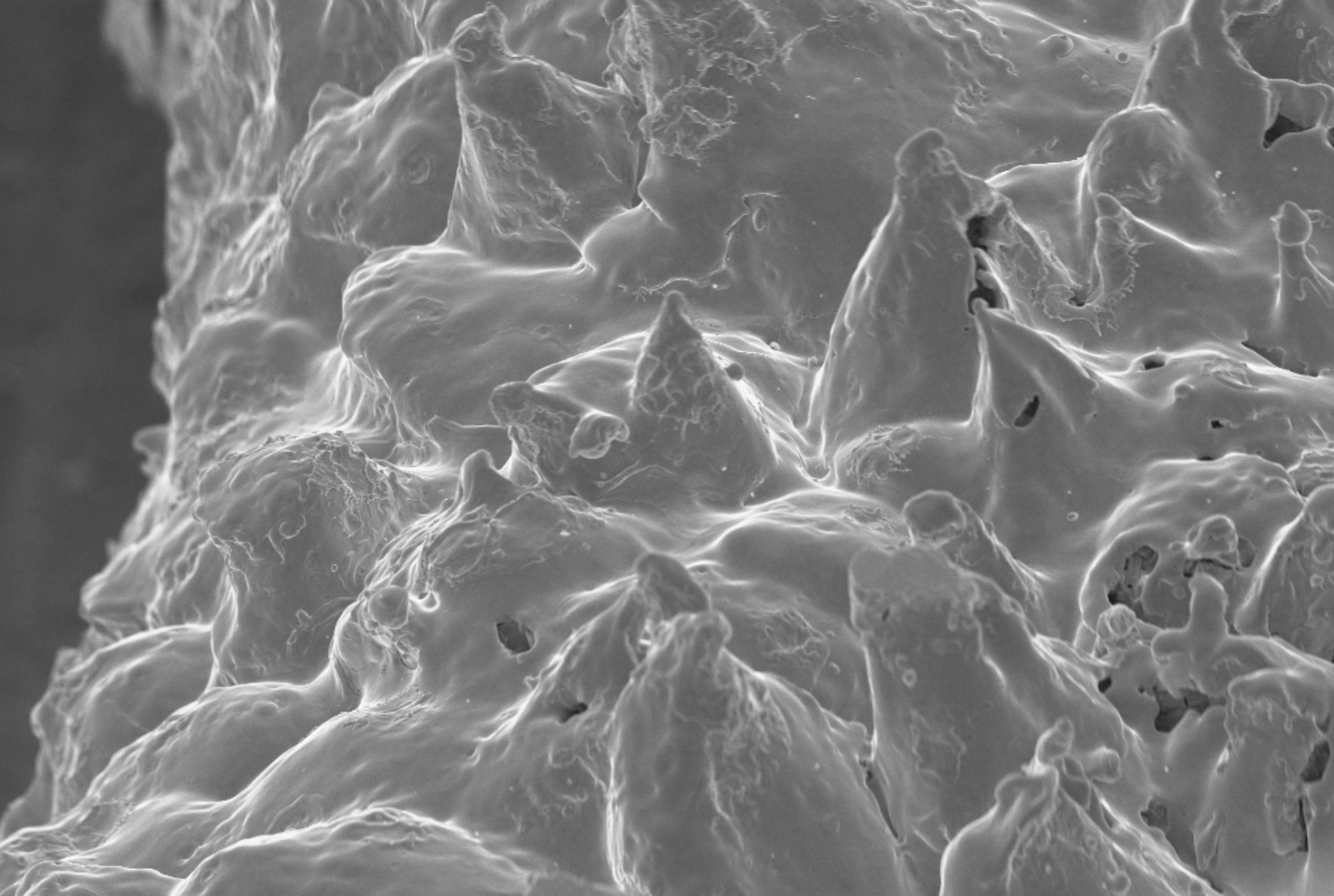
Mag = 200 X  
EHT = 20.00 kV  
Detector = SE1

100µm



HDS11Ti, iris -2, 55°

File Name = HDS11Ti-29.tif  
Date :19 Dec 2006  
G. Arnau TS/MME



Mag = 200 X  
EHT = 20.00 kV  
Detector = SE1

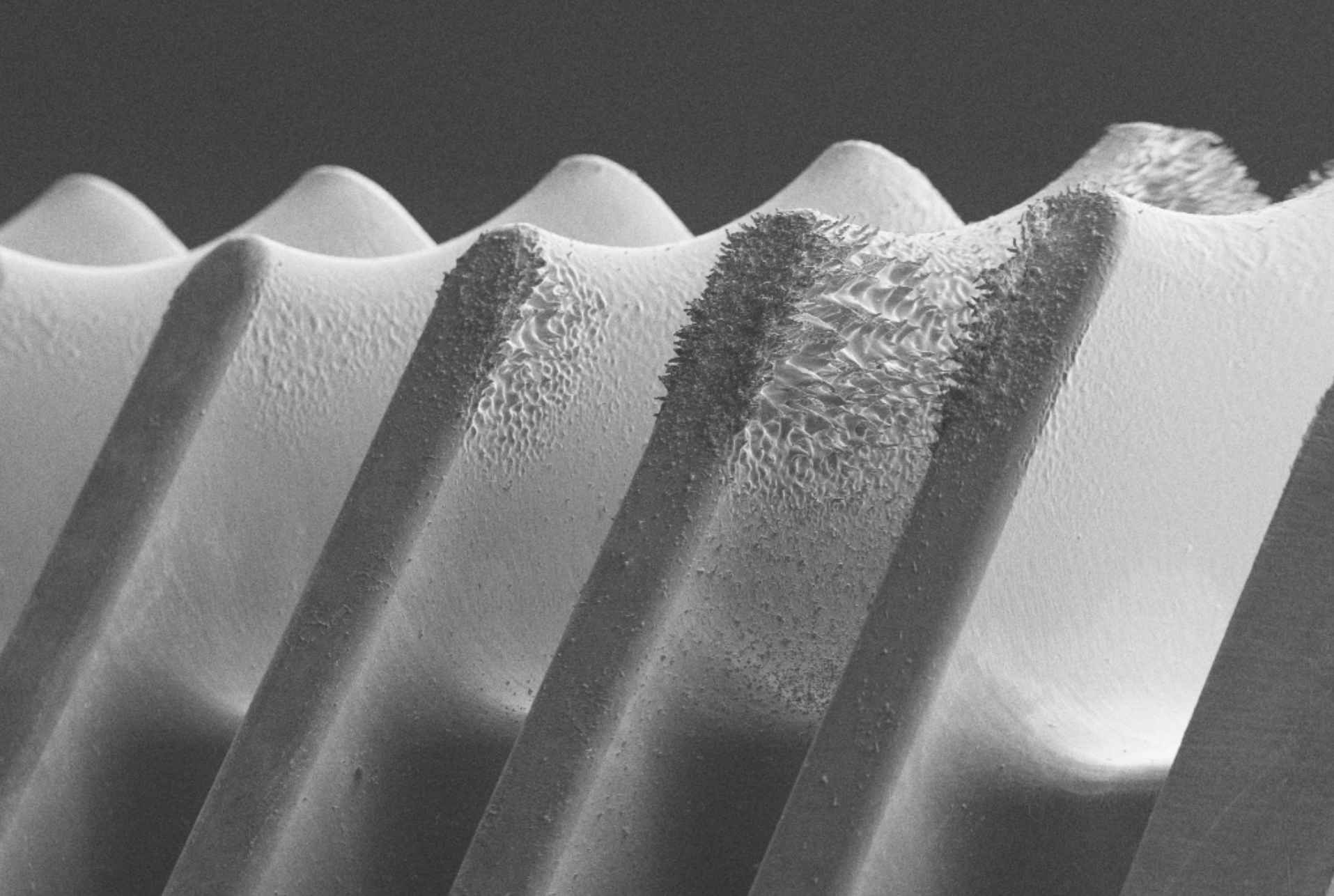
100µm



Mo iris structure @ CTF3 2005. Iris 1-. Tilt =50

File Name = CTF3020.tif  
Date :17 Mar 2006  
G. Arnau TS/MME



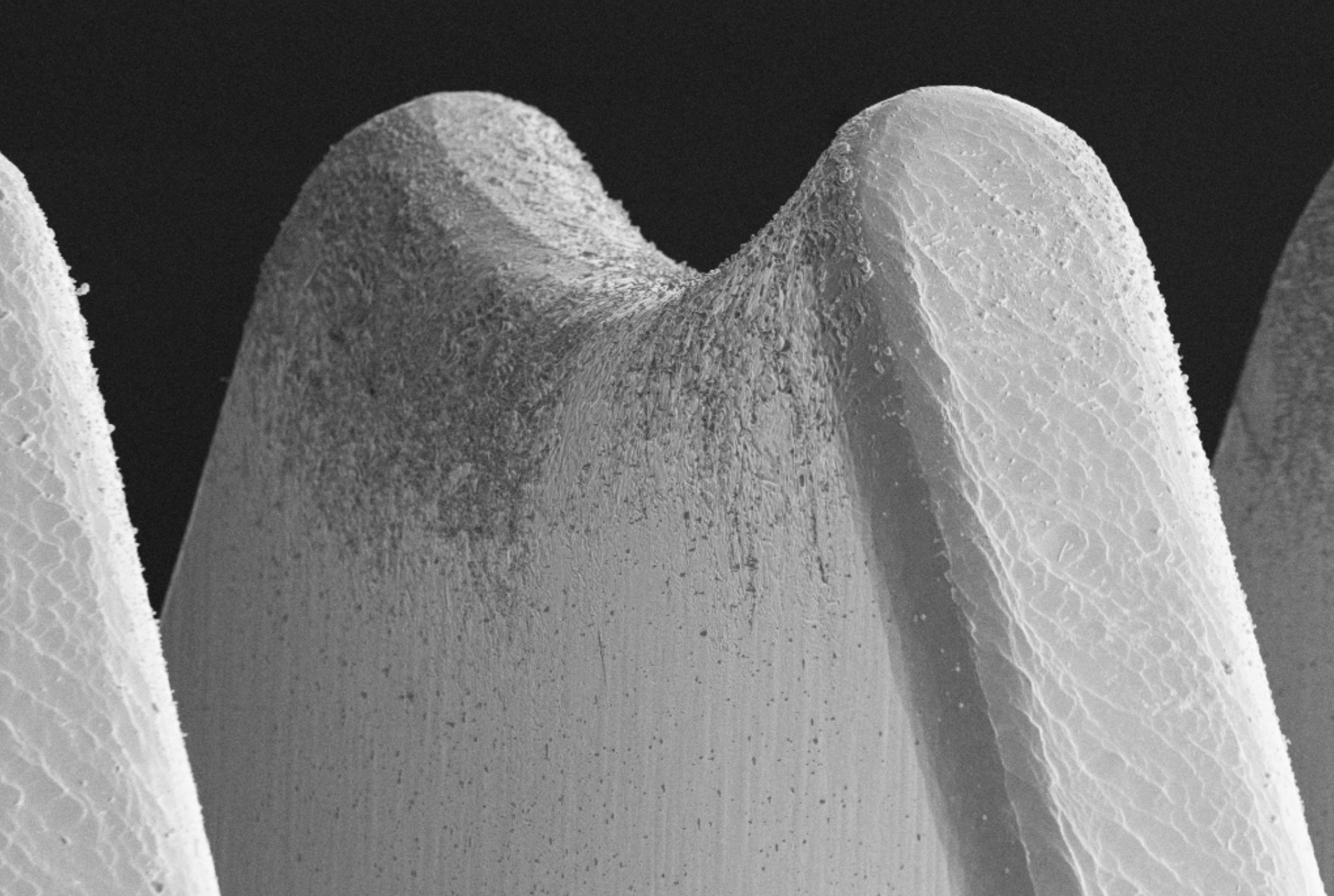


Mag = 16 X  
EHT = 20.00 kV  
Detector = SE1

1mm



HDS11Ti, iris -1to -5, 55° File Name = HDS11Ti-33.tif  
Date :19 Dec 2006  
G. Arnau TS/MME



Mag = 50 X  
EHT = 20.00 kV  
Detector = SE1

1mm

HDS60Cu, iris 8, 18°

File Name = HDS60Cu-15.tif  
Date :11 Jan 2007  
G. Arnau TS/MME

# Pool of images

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