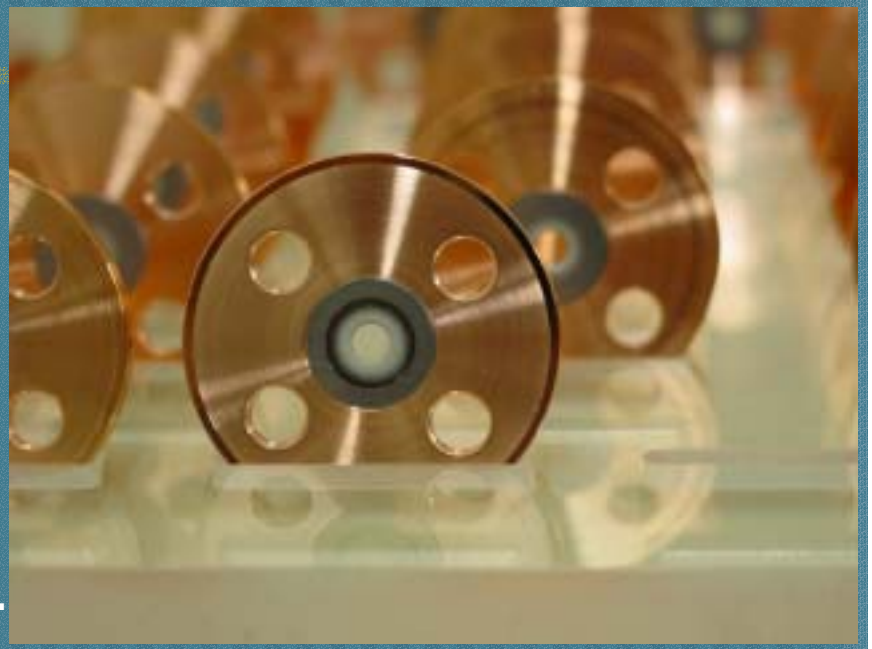
Analysis of CTFII structures.

Iris of W and Mo.

Introduction.

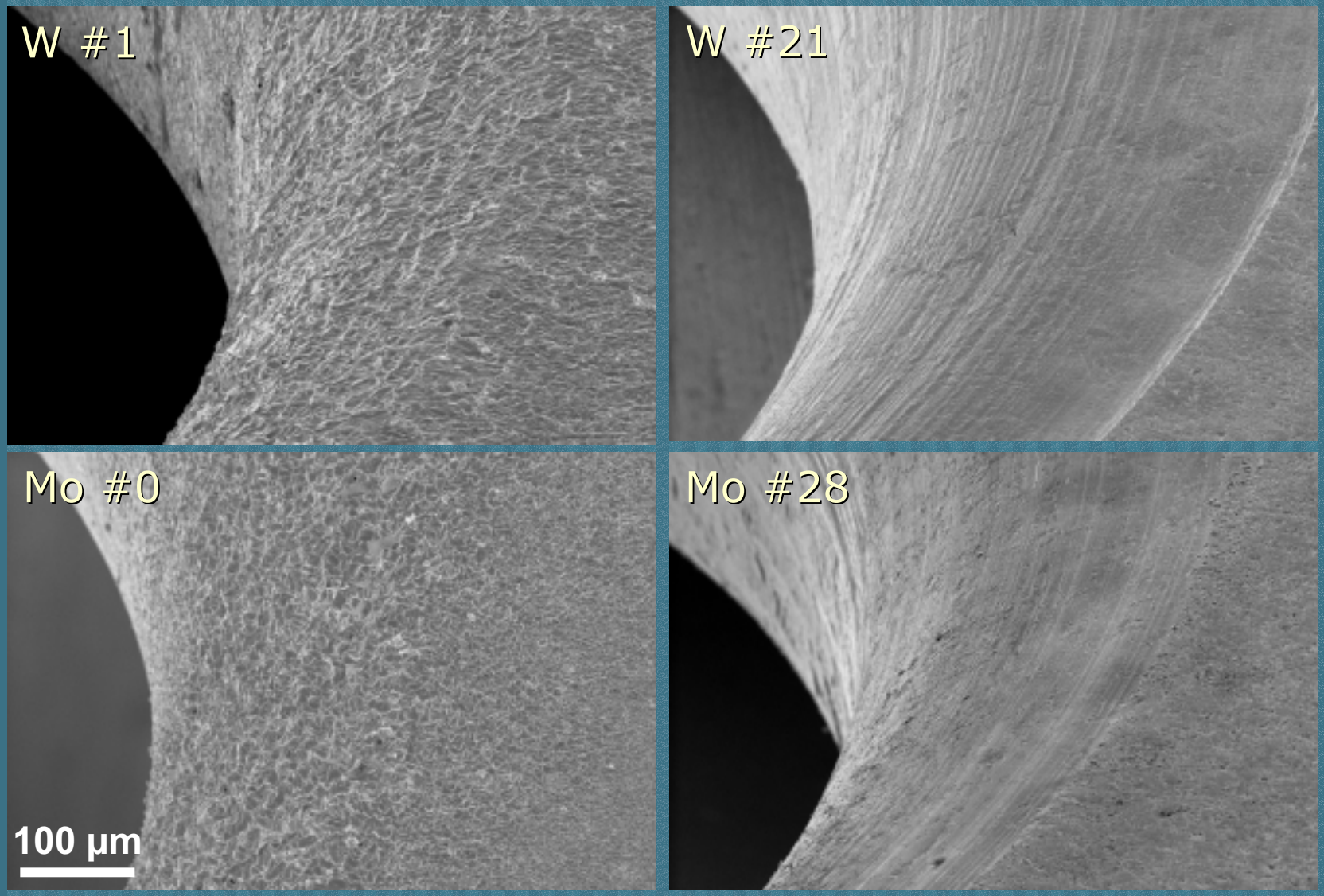


- Background:
  - Iris-in-copper-disc structures.
  - Run in CTF II at 30 GHz.
  - Materials:
    - W, no vacuum fired.
    - Mo, vacuum fired, highest gradient.
  - Naked eye observations:
    - Color differences in the first 1/3 of iris.
    - Arcing signs.
- ➔ Analyses:
  - Surface SEM + EDS for first and intermediate cavities.
  - Cross-section and fracture surface of first Mo iris.

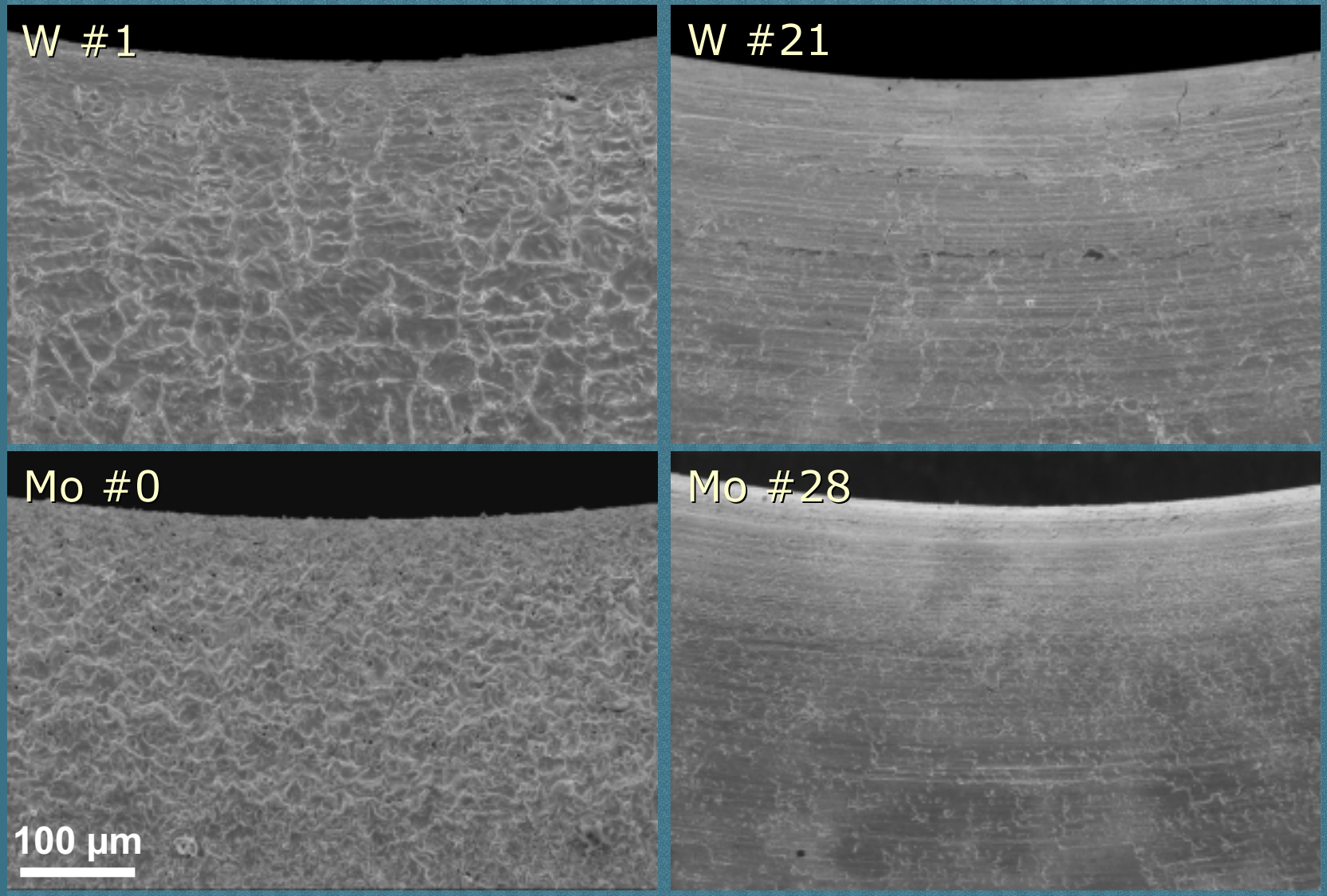
Contents.

- Intro.
- Surface modifications.
  - Overview.
  - Comparative 1st/general and Mo/W.
  - Detail for W.
  - Detail for Mo
  - Metal loss in 1st irises.
- Arcing in Cu-iris transition.
- Machining issues.
- Fatigue cracks in Cu discs?

Surface modification in tip region. Comparative 1st/mid-position and W/Mo.



Surface modification in tip region. Comparative 1st/mid-position and W/Mo.



- Results in old structures, for comparison.

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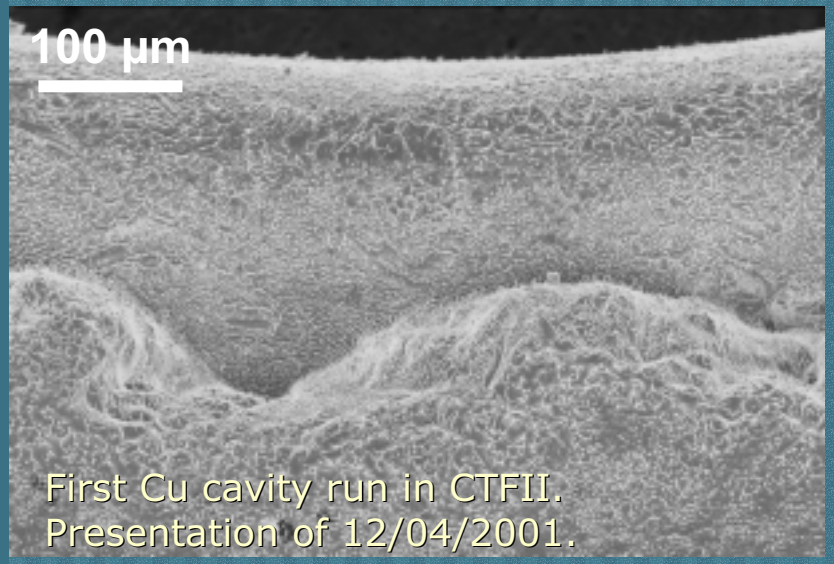
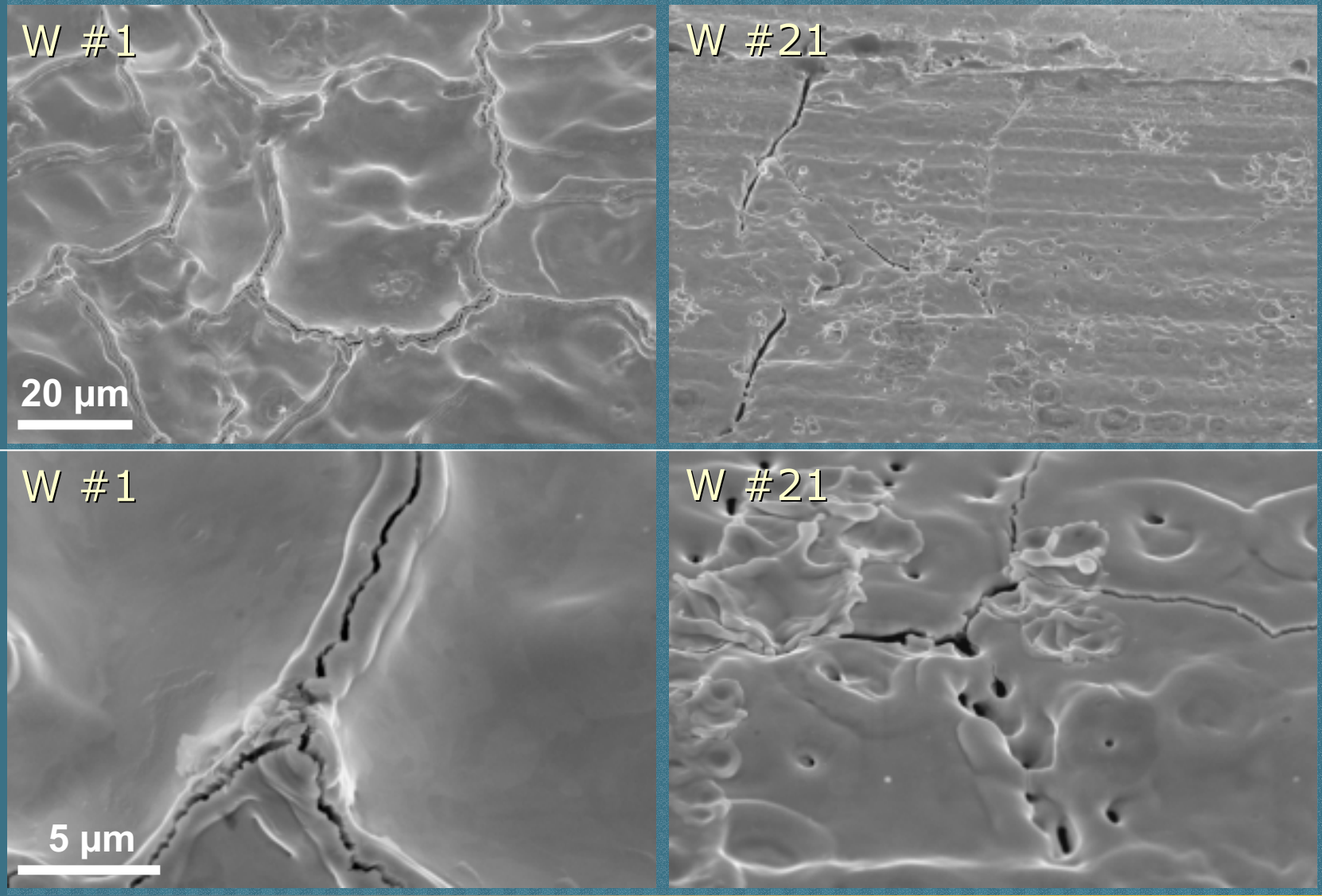


First Cu cavity run in CTFII.
Presentation of 12/04/2001.

First W iris run in CTFII.
Presentation of 19/11/2001.

Surface modification in tip region. W structure, comparative 1st/mid-position.



- Comparative with previous experience on thermal cracks in W rod pieces.

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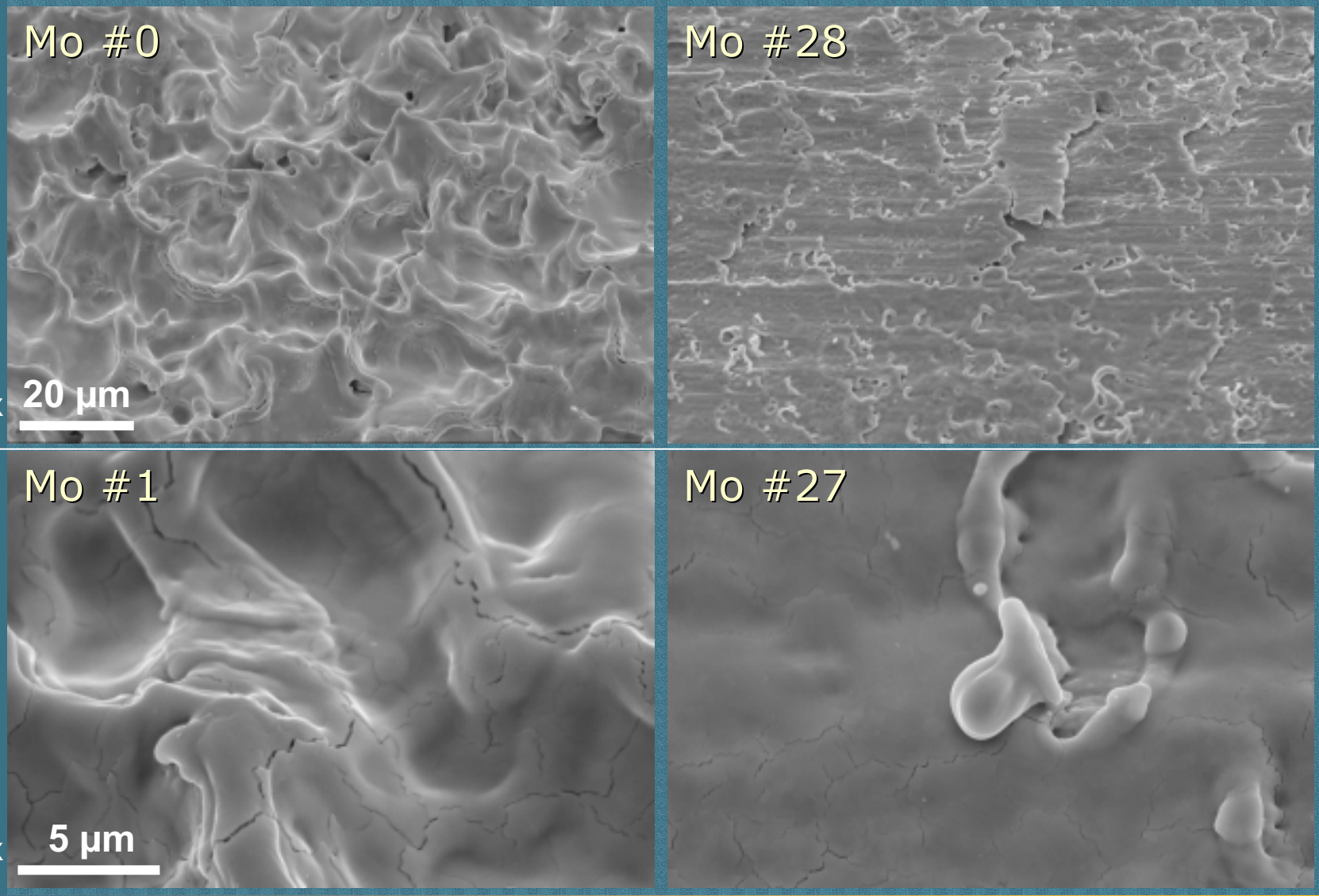
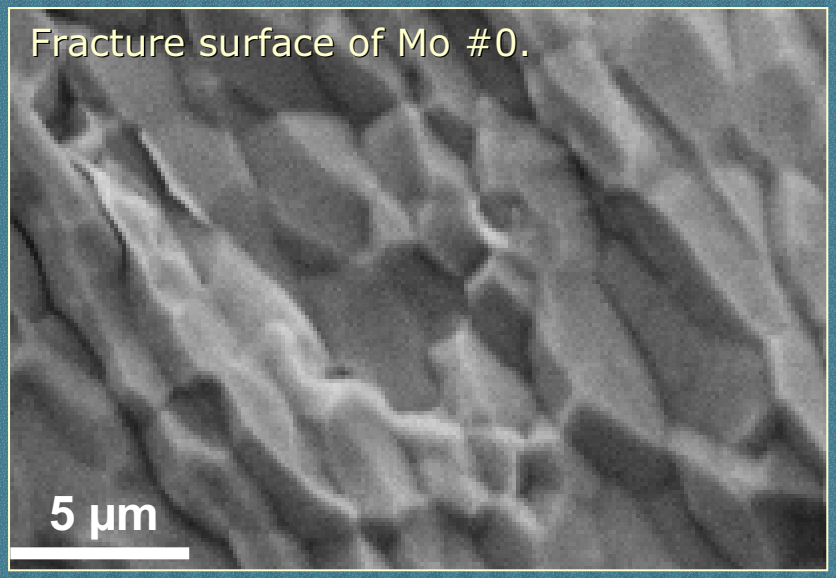
W iris made by EDM and e-polished.
Presentation of 21/08/2001.

Surface modification in tip region. Mo structure, comparative 1st/mid-position.



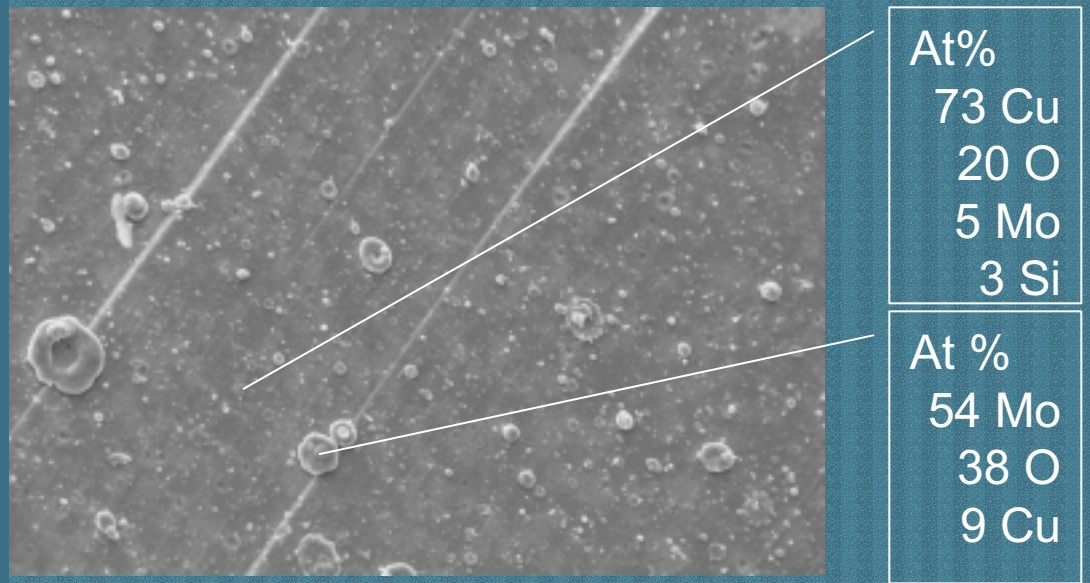
- Grain size of Mo irises from fractography.



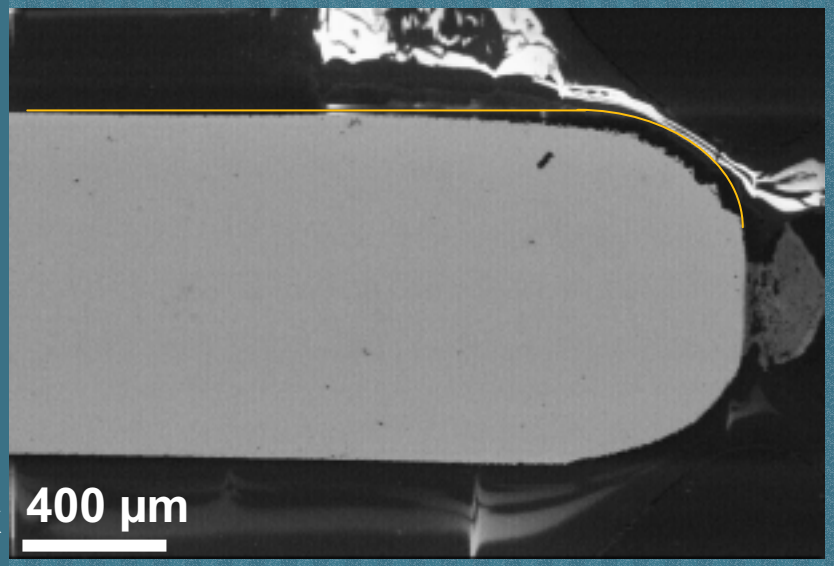
Surface modification in tip region. Metal loss in 1st irises.

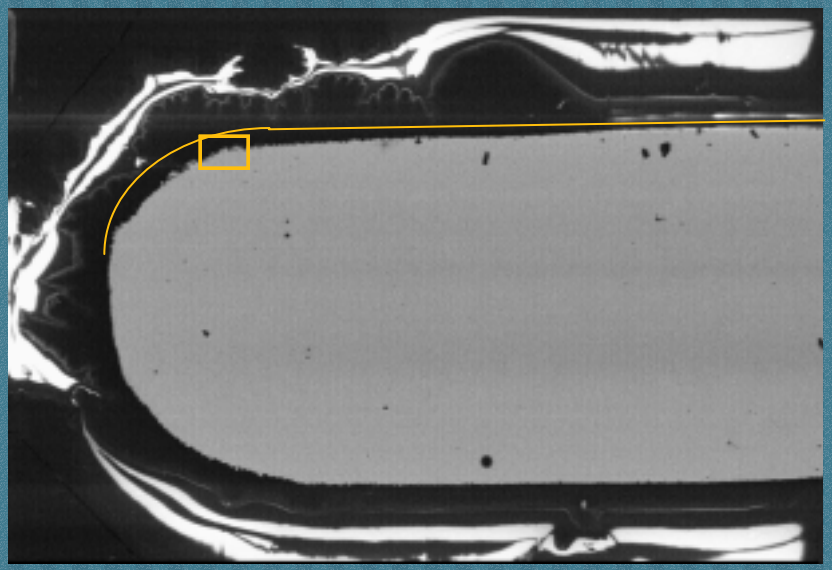
- Indications of metal loss in 1st irises:
  - Metal projections towards Cu discs.
  - Mo evaporation (Blackening of iris and Cu disc, due to deposit of MoO_3).
  - Reduction of cross-section of 1st Mo iris.

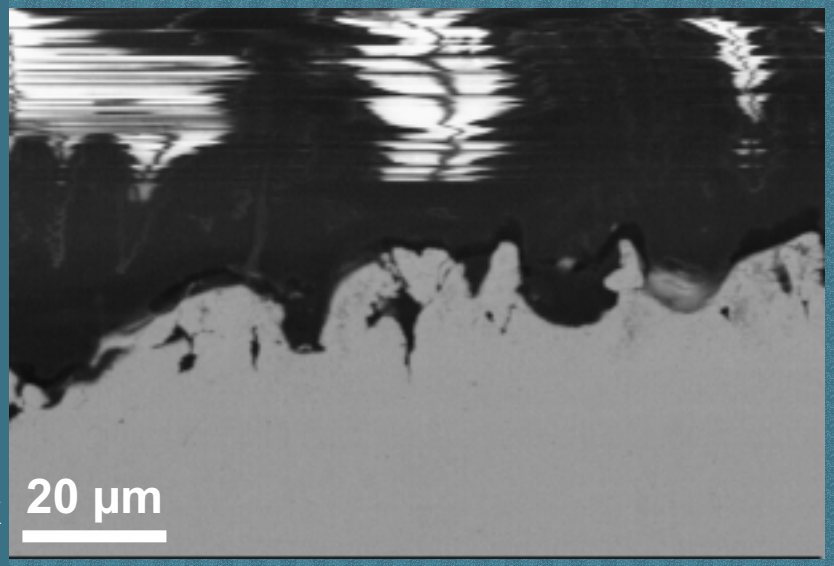
Wall (Cu disc) of 1st cavity from Mo structure.



Surface modification in tip region. Cross-section of Mo #0.





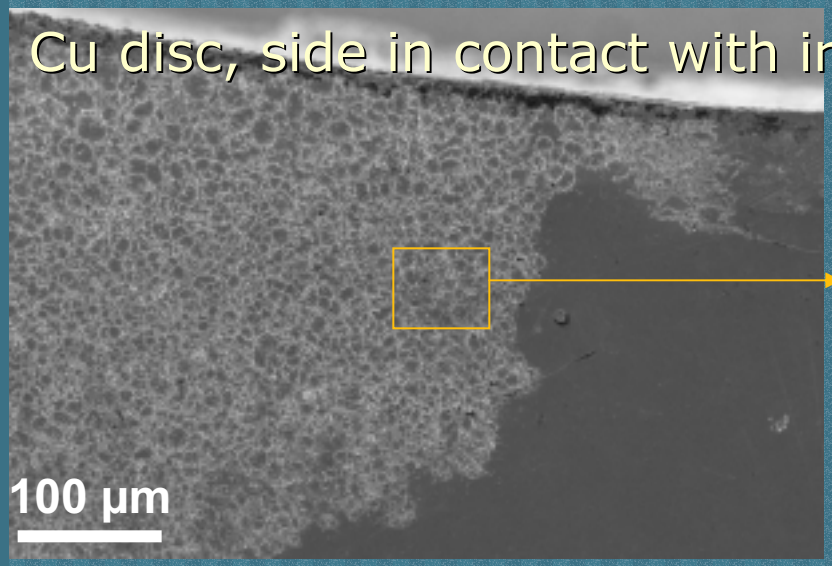


- Slight loss of material or previous geometrical defect.
- Protrusions are 15 µm high.
- Cracks are superficial.

Surface modification in tip region of irises.

- Surface modifications are marginal in general, no severe metal loss.
- 1st irises more severe modifications than mid-position irises for both W and Mo.
- Melting crests + network of micro cracks.
- W:
  - Crack network of ~ 50 μm
  - → Does it corresponds to Prior Particle Boundaries? No, in principle W powder is 2÷6 μm.
  - Melting crests in 1st irises are coincident with cracks.
  - Pits and craters in mid-position irises but seldom in 1st irises
  - → Are pits and cracks channels for degassing of impurities? Possible cleaning effect in surface material due to higher field conditions in 1st irises would explain reduced amount of pits.
  - → Is heating more intense around cracks?.
- Mo:
  - Chaotic melting crests.
  - Cracks less opened than in W and form a finer mesh network, ~ 3μm (same size as grains observed in fractured iris).
  - Cracks are very superficial.

Arching in Cu-to-iris transition.



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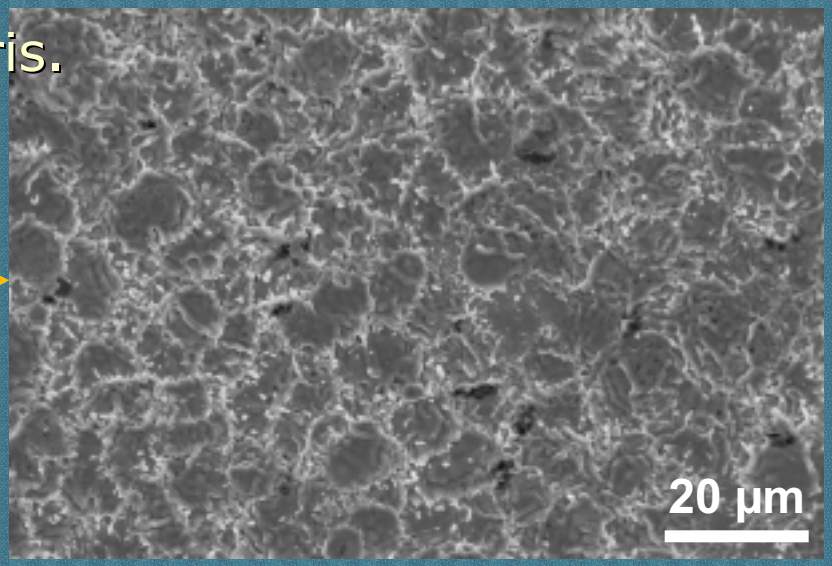

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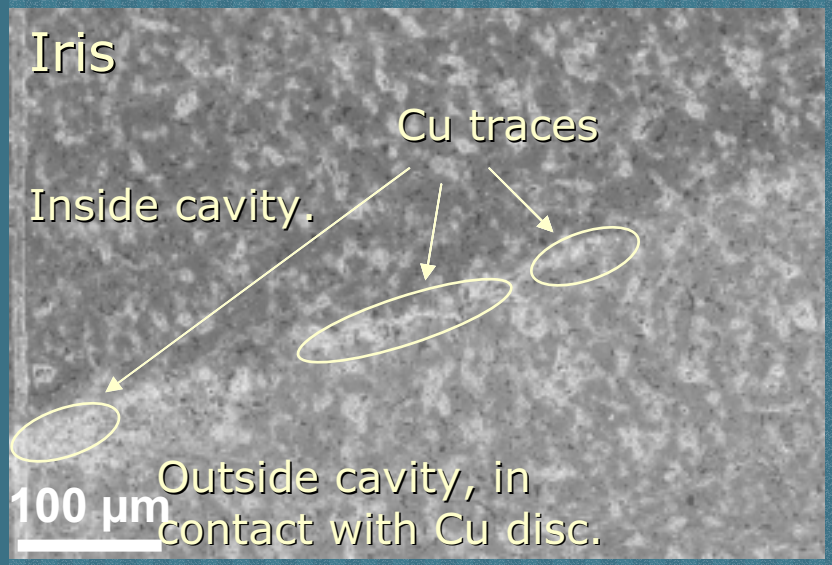

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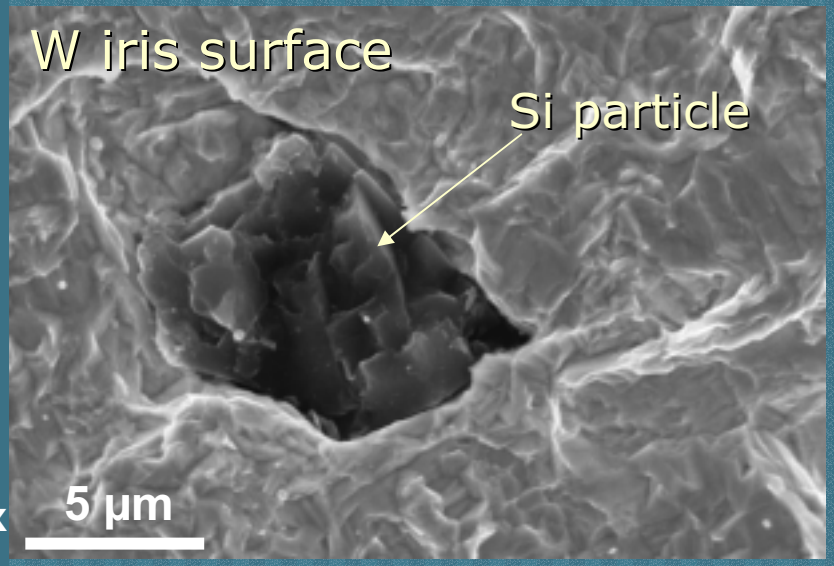
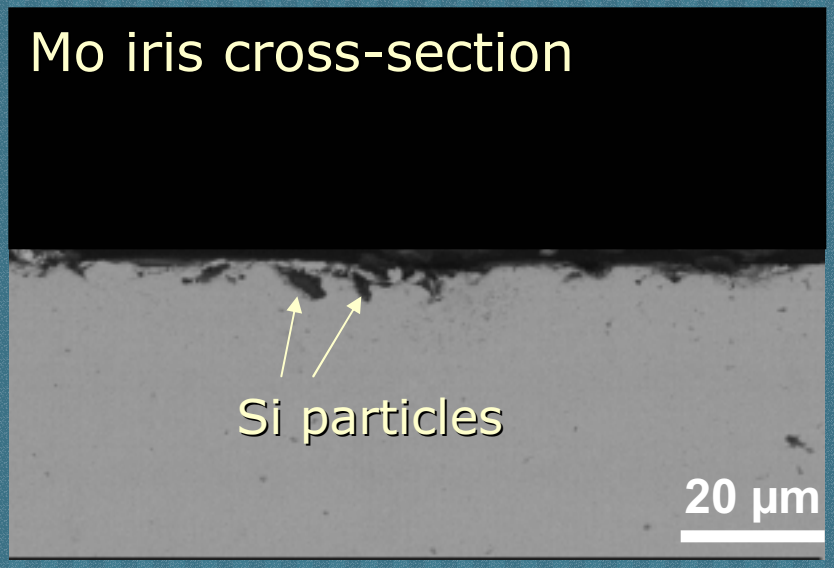
- Extensive copper splashes in particular disc to iris contact regions (In W structure, clamped less tightly)
- Also systematic presence of Cu traces along the cavity boundary line (in both, W and Mo structures)

Machining issues.

1. Si particles inlayed in ground (flat) surfaces of irises:
   - In both, W and Mo.
   - Regular distribution and size, ~ 10 μm.
   - It is not SiC, not SiO_2.





Machining issues.

2. Poor machining finish in one Mo iris.
3. Steel traces in one W iris.