

THE STUDY OF NITINOL WELDS FOR ELECTRIC GENERATOR AND DESIGN OF SEM STRAIN STAGE

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Brandon Hoffman

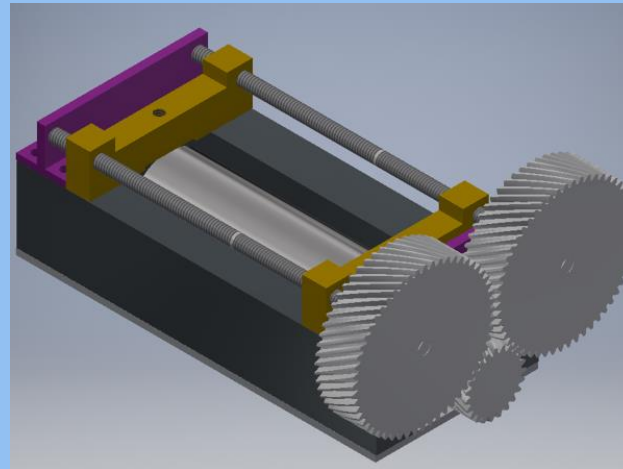
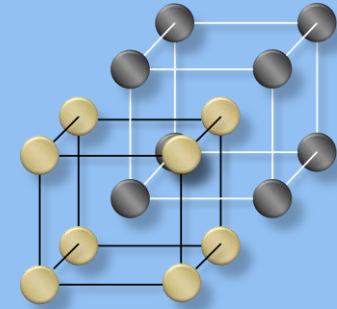
&

Joe Kellogg

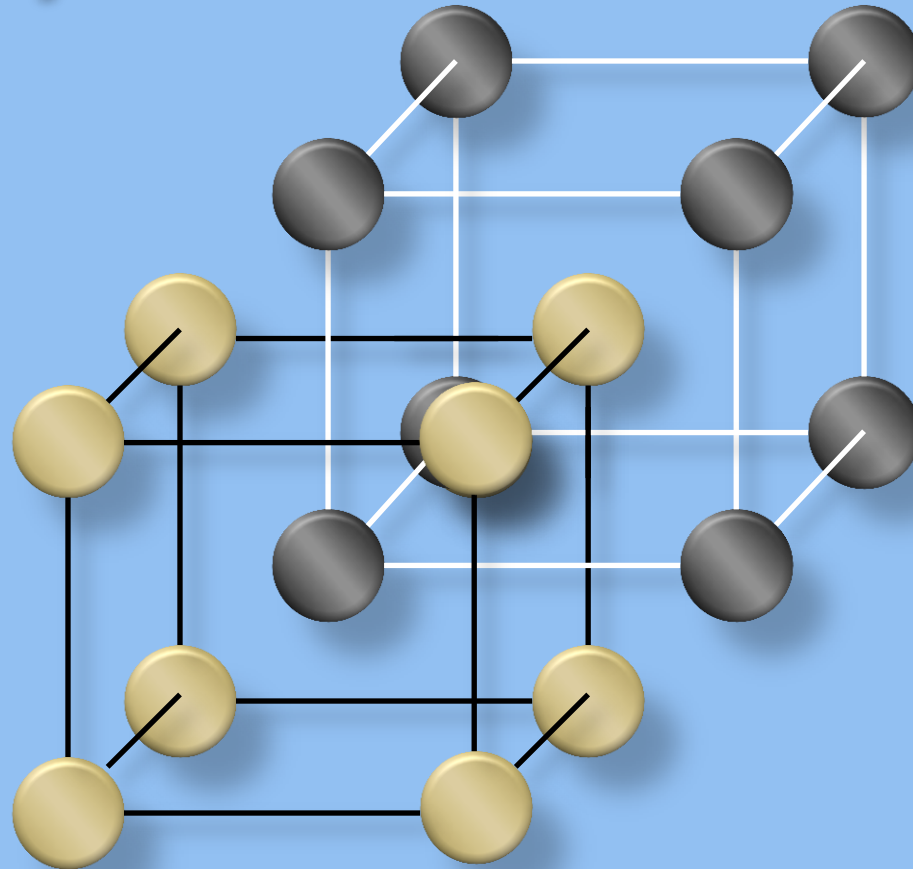


Overview

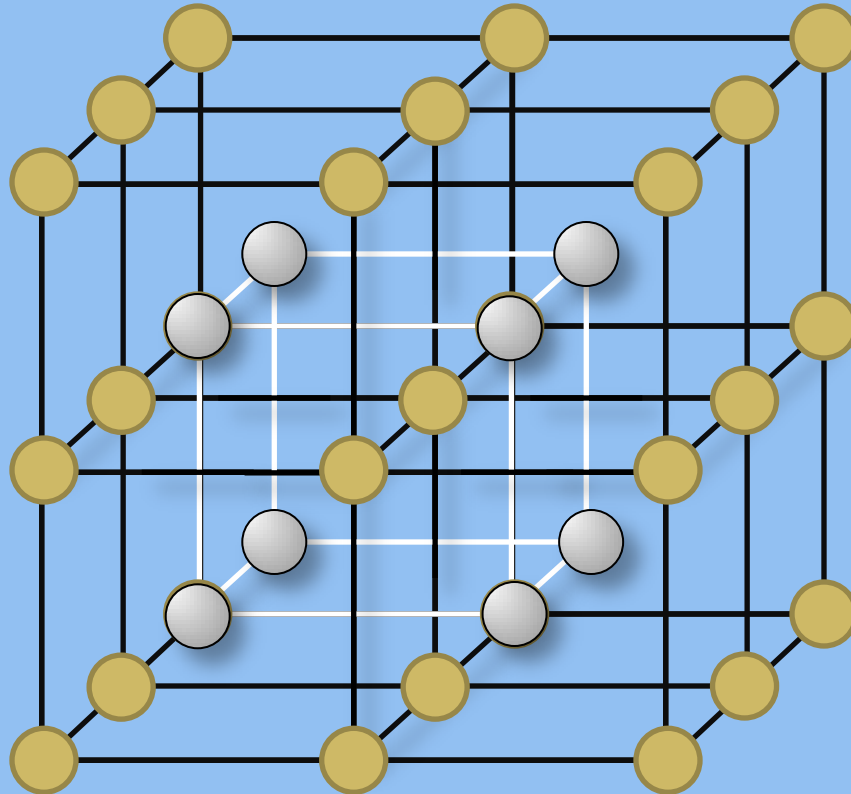
- ▣ What is Nitinol
- ▣ Joe Kellogg's plan
- ▣ Weld analysis with Scanning Electron Microscope (SEM)
- ▣ Design of strain stage for SEM



Crystal Structure

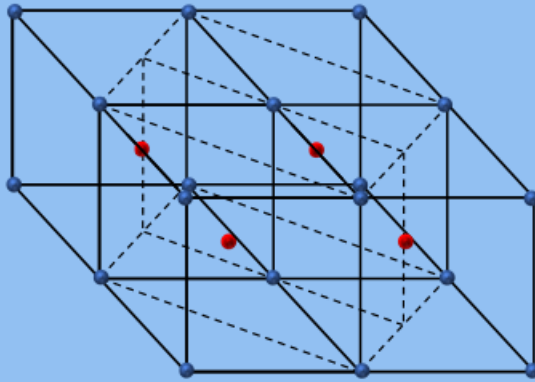


Crystal Structure

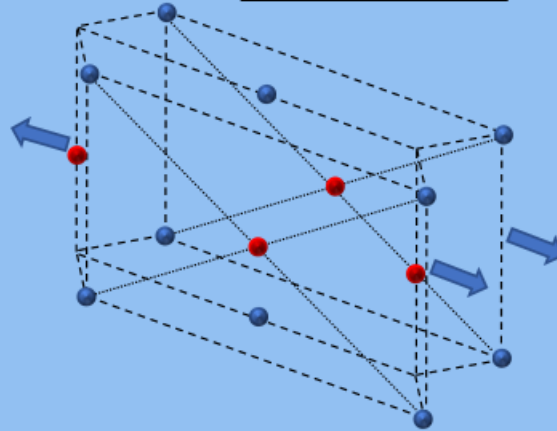


Nitinol structure

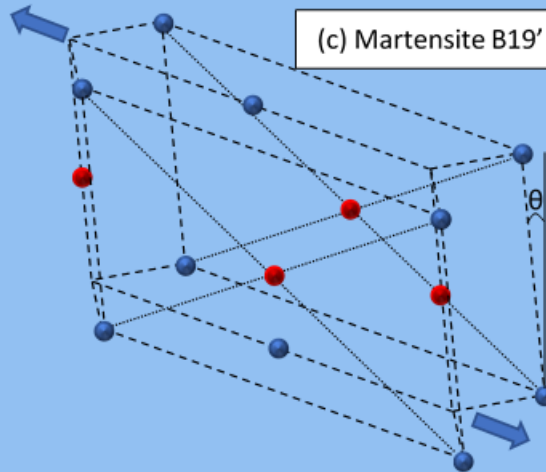
(a) Parent Austenite B2

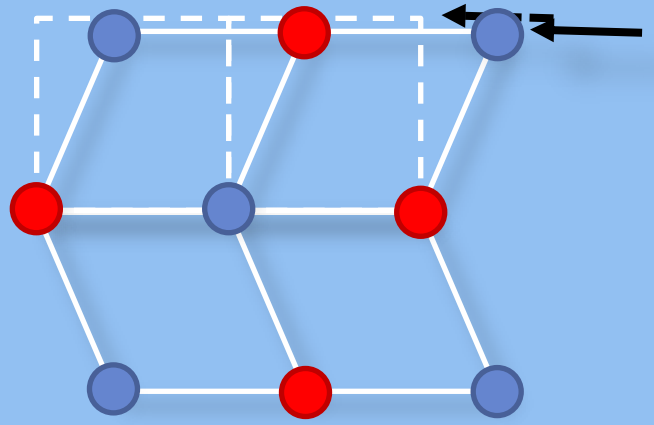
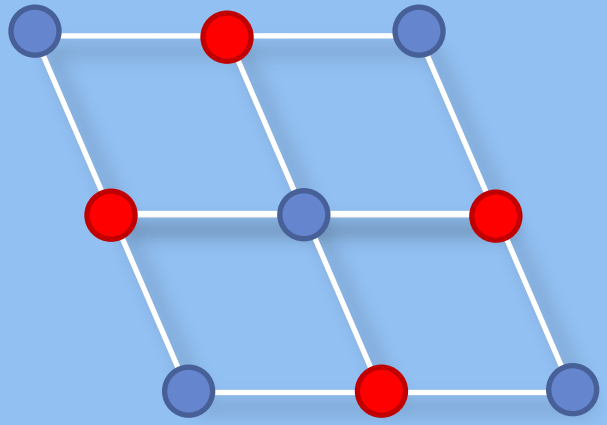
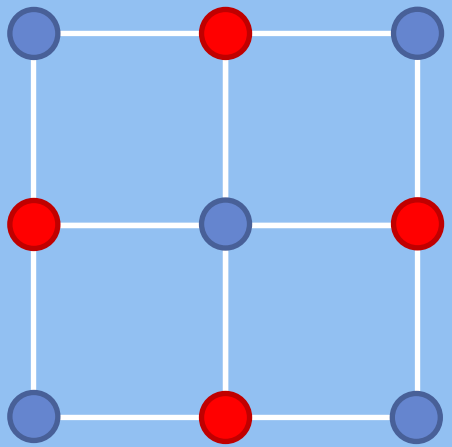


(b) Martensite B19

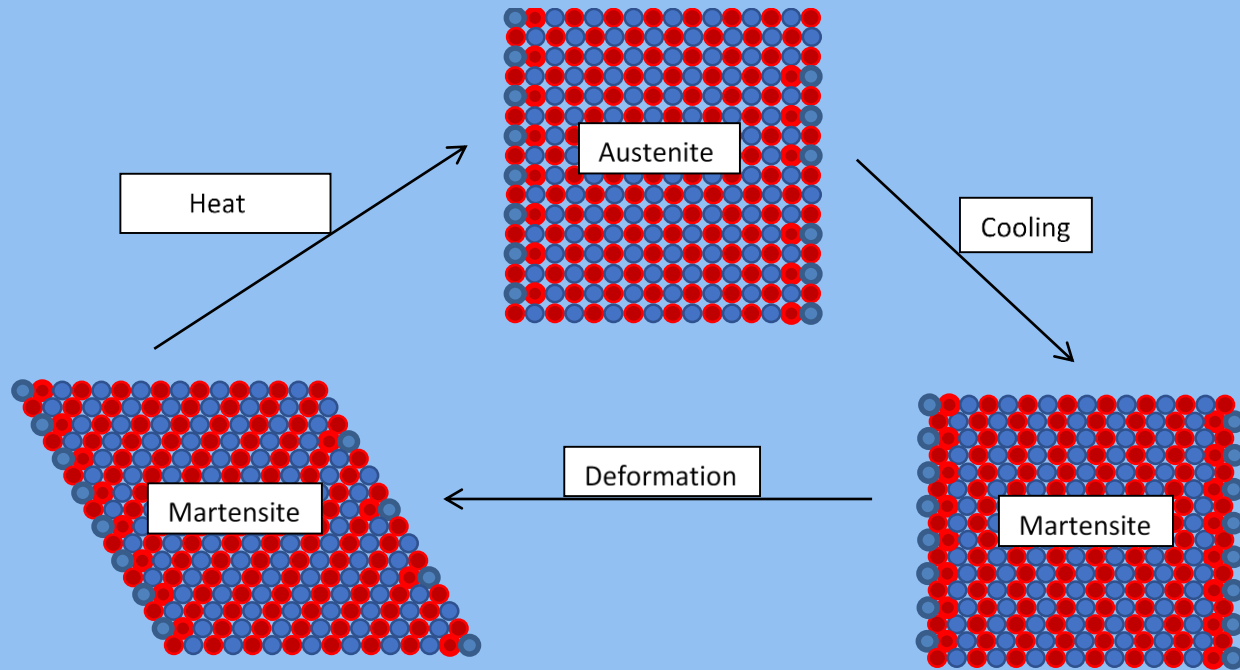


(c) Martensite B19'

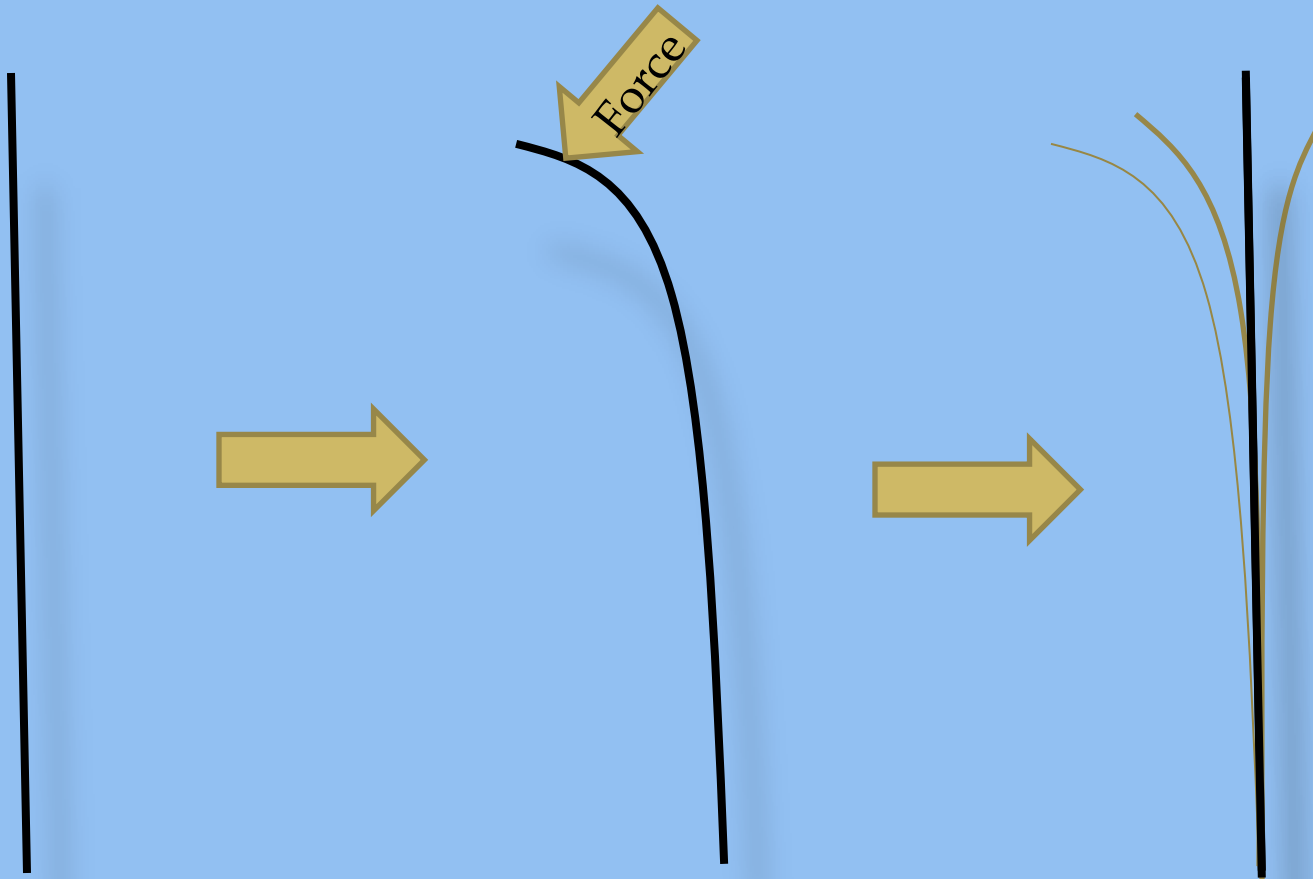




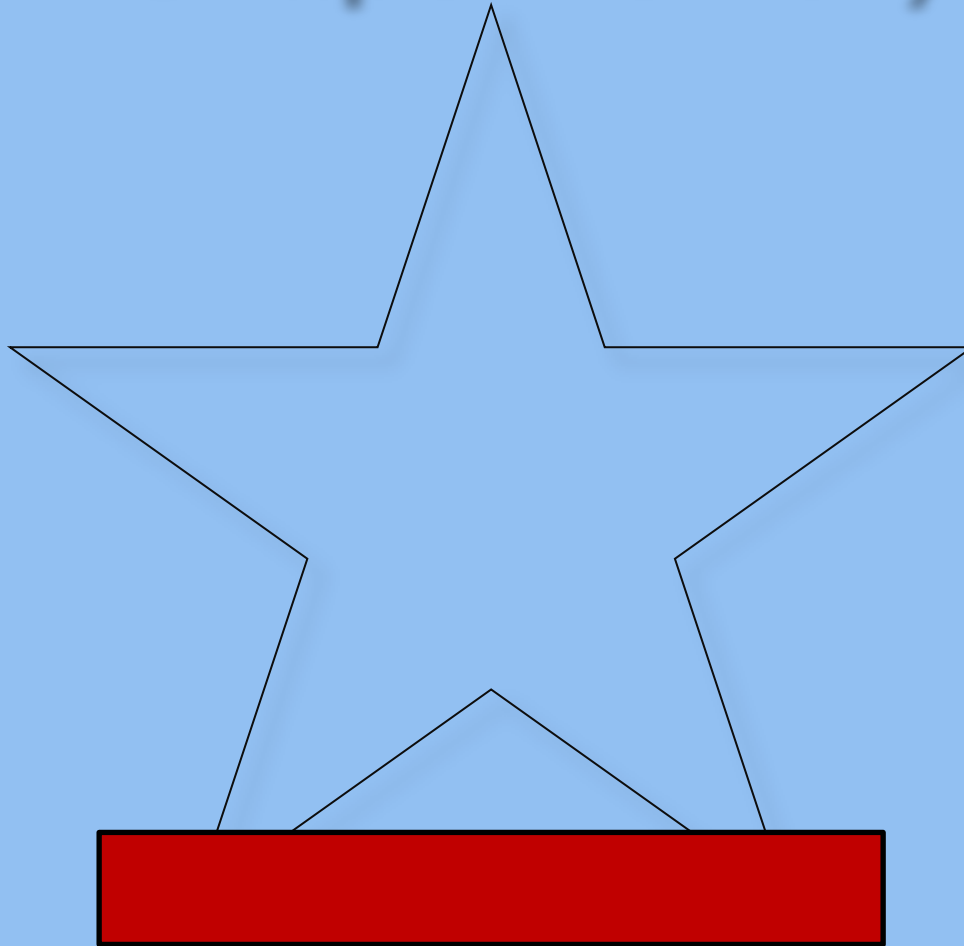
Cycles of Nitinol



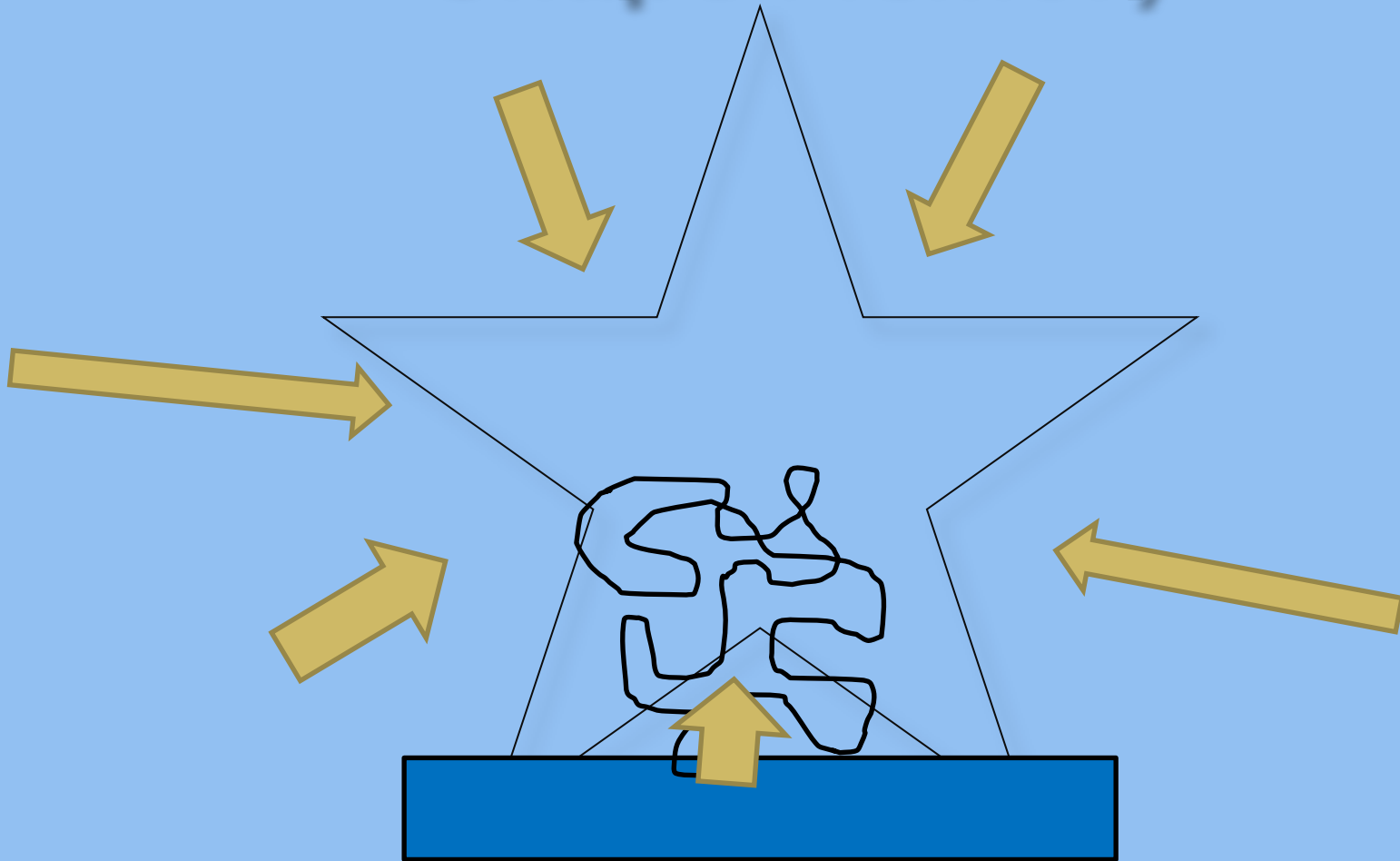
Super elasticity



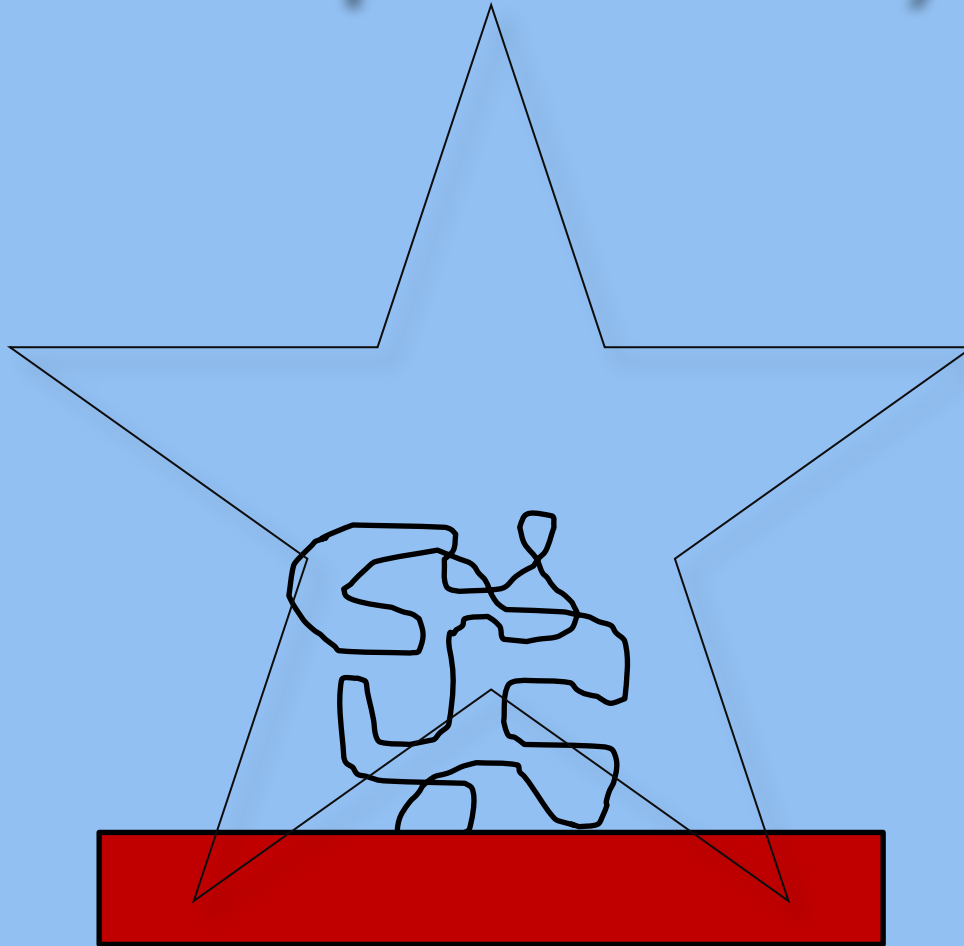
Shape Memory



Shape Memory

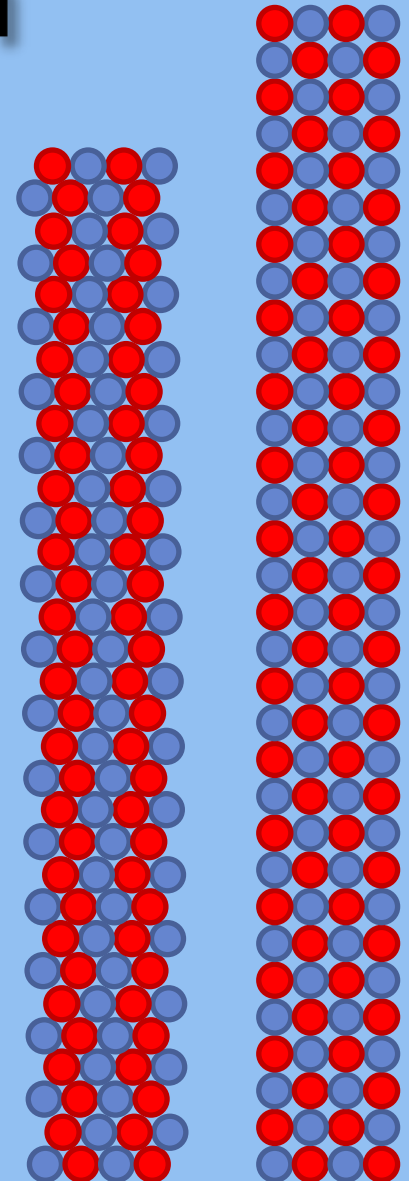


Shape Memory



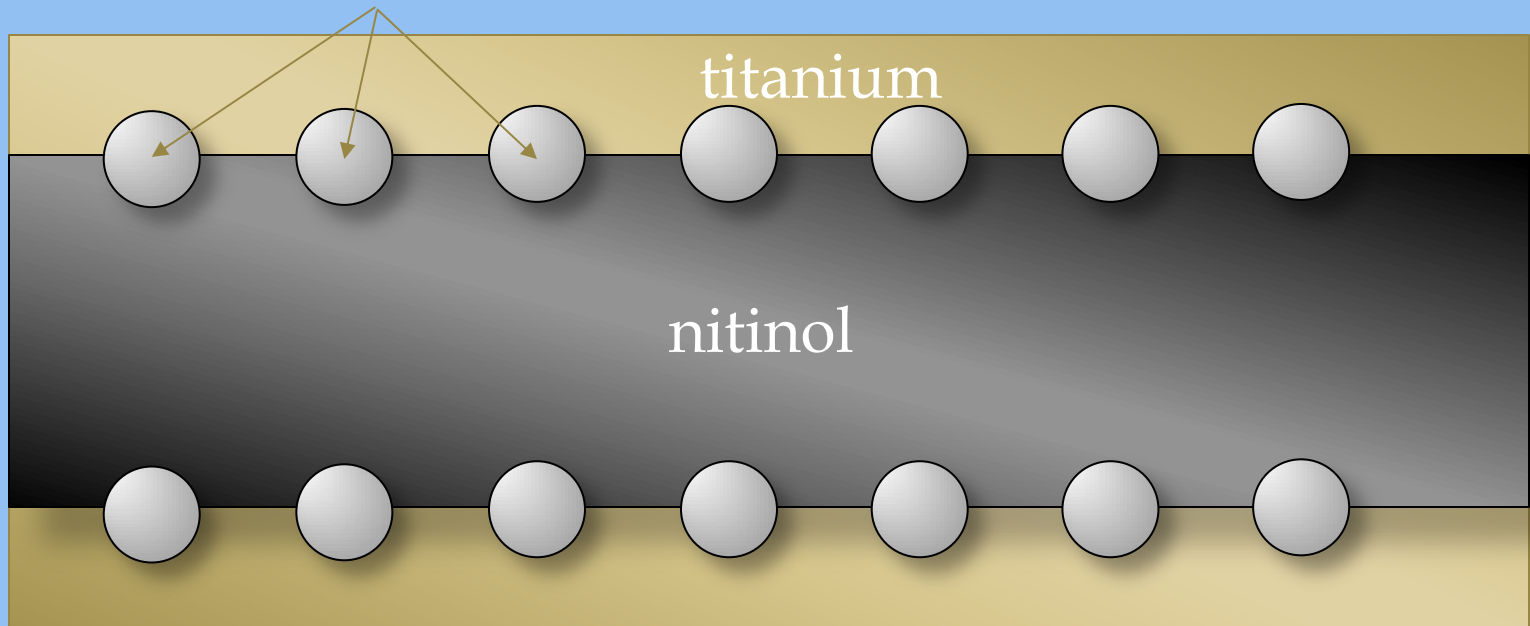
Joe Kellogg's Plan

- Nitinol Generator
- Green & renewable
- countless applications



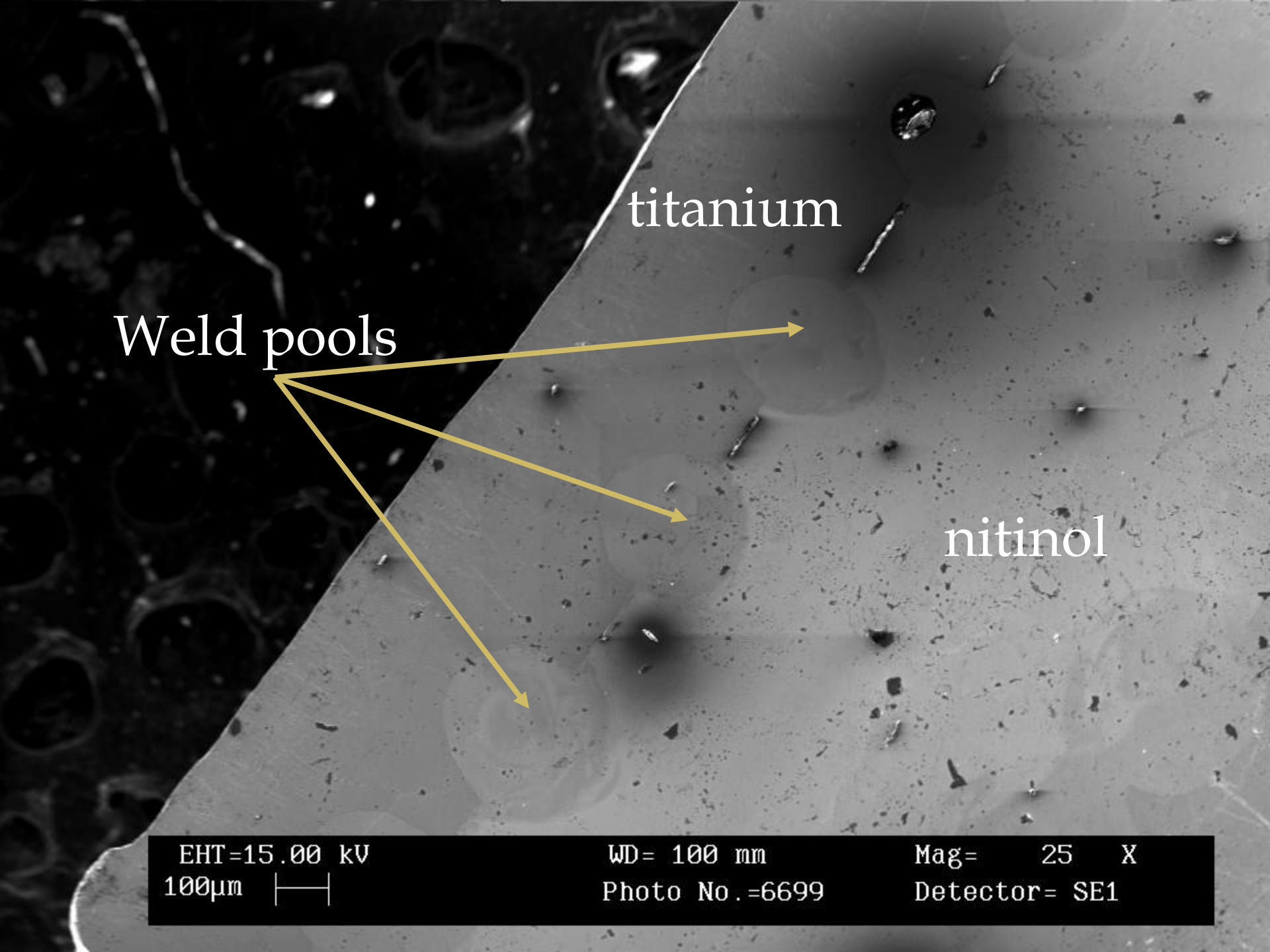


Weld pools



titanium

nitinol



titanium

Weld pools

nitinol

EHT=15.00 kV

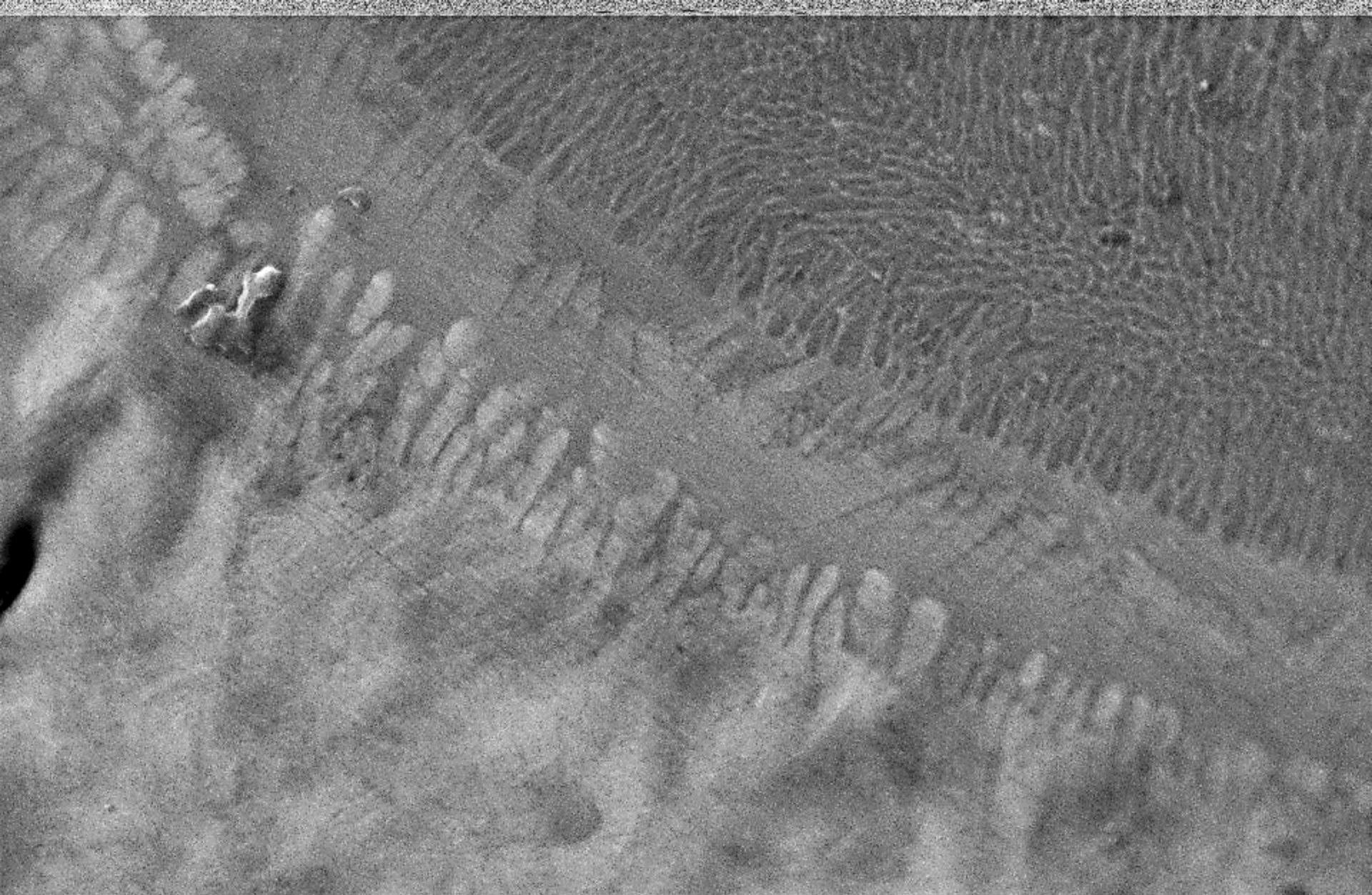
WD= 100 mm

Mag= 25 X

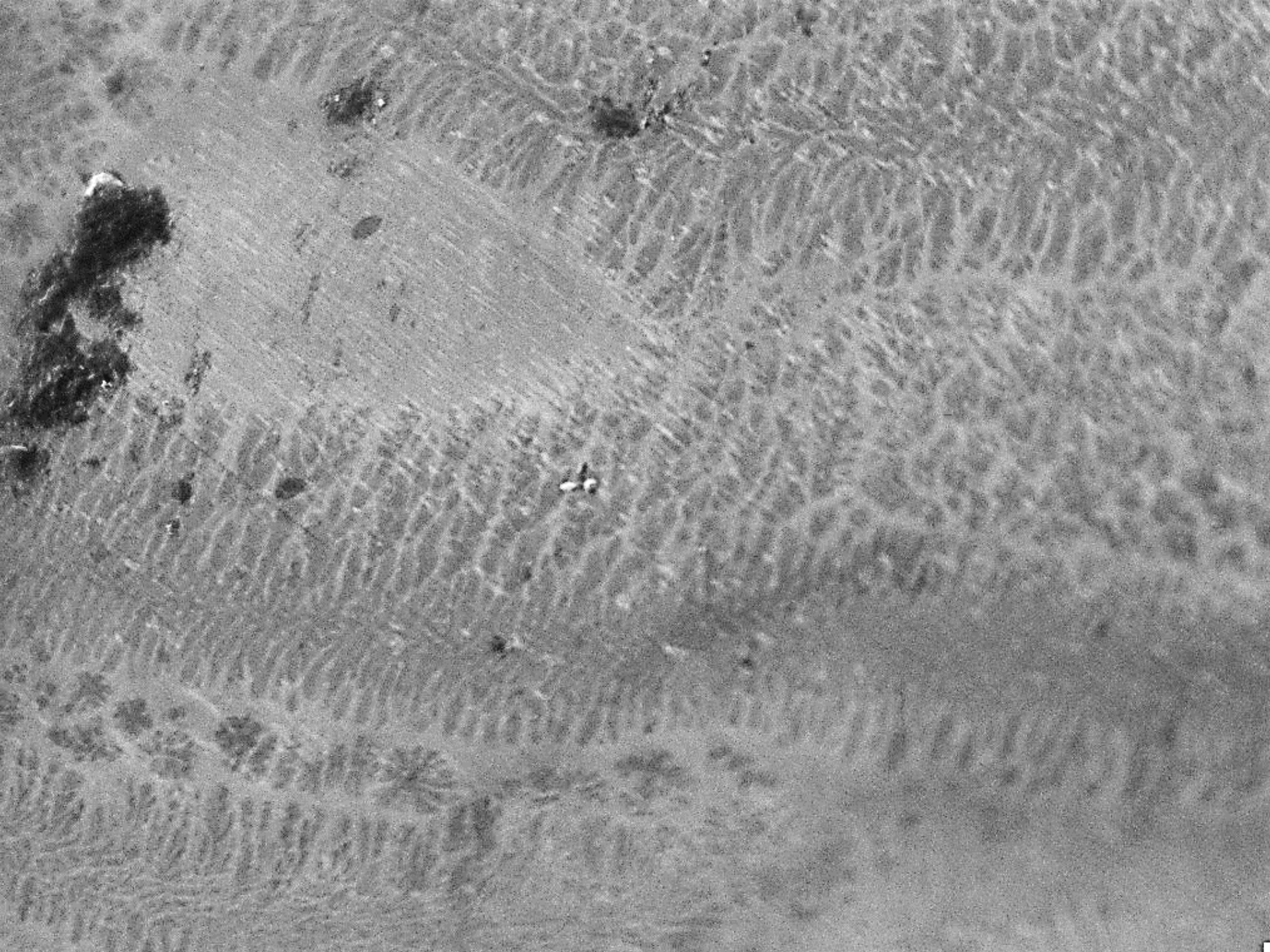
100µm

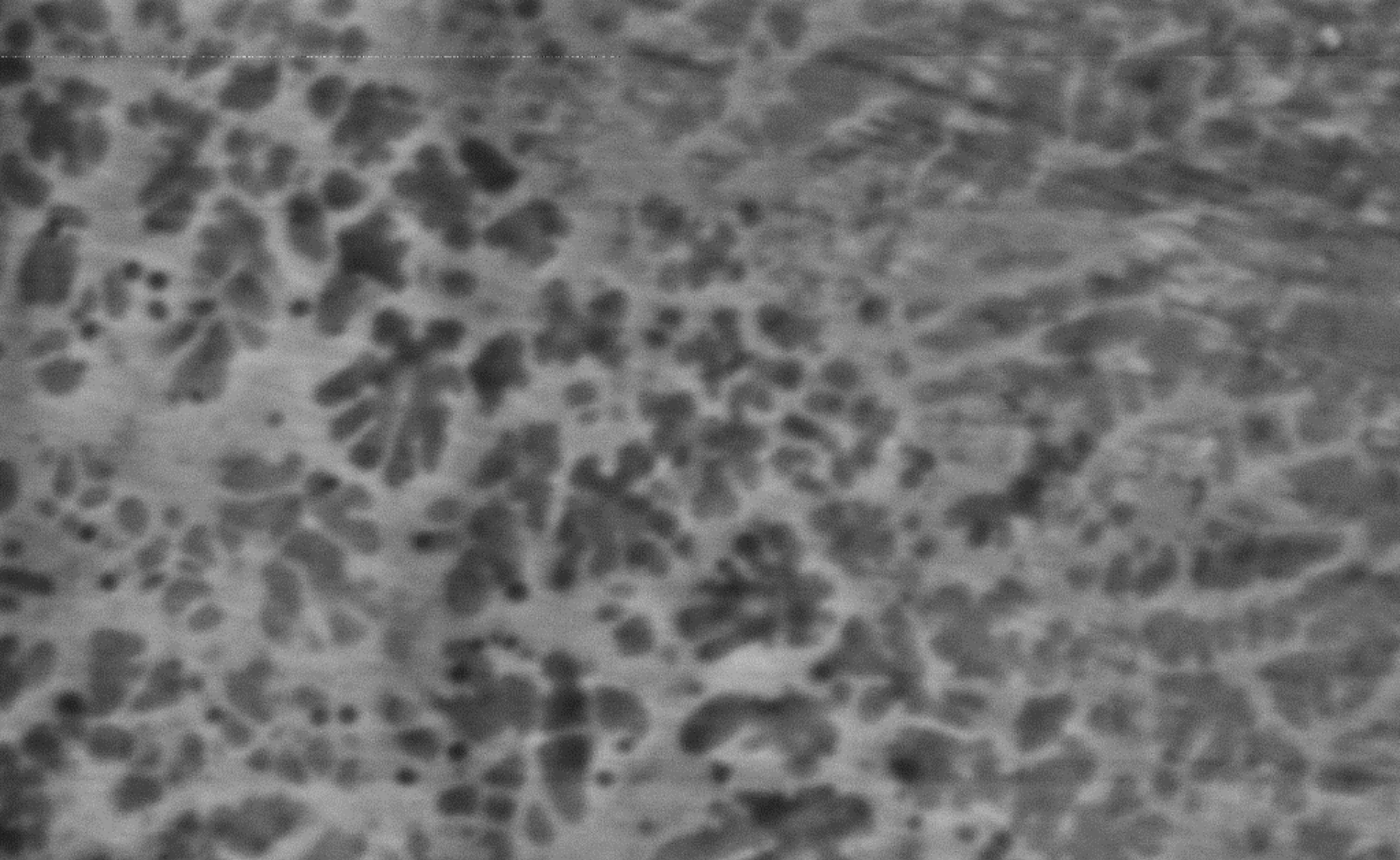
Photo No.=6699

Detector= SE1

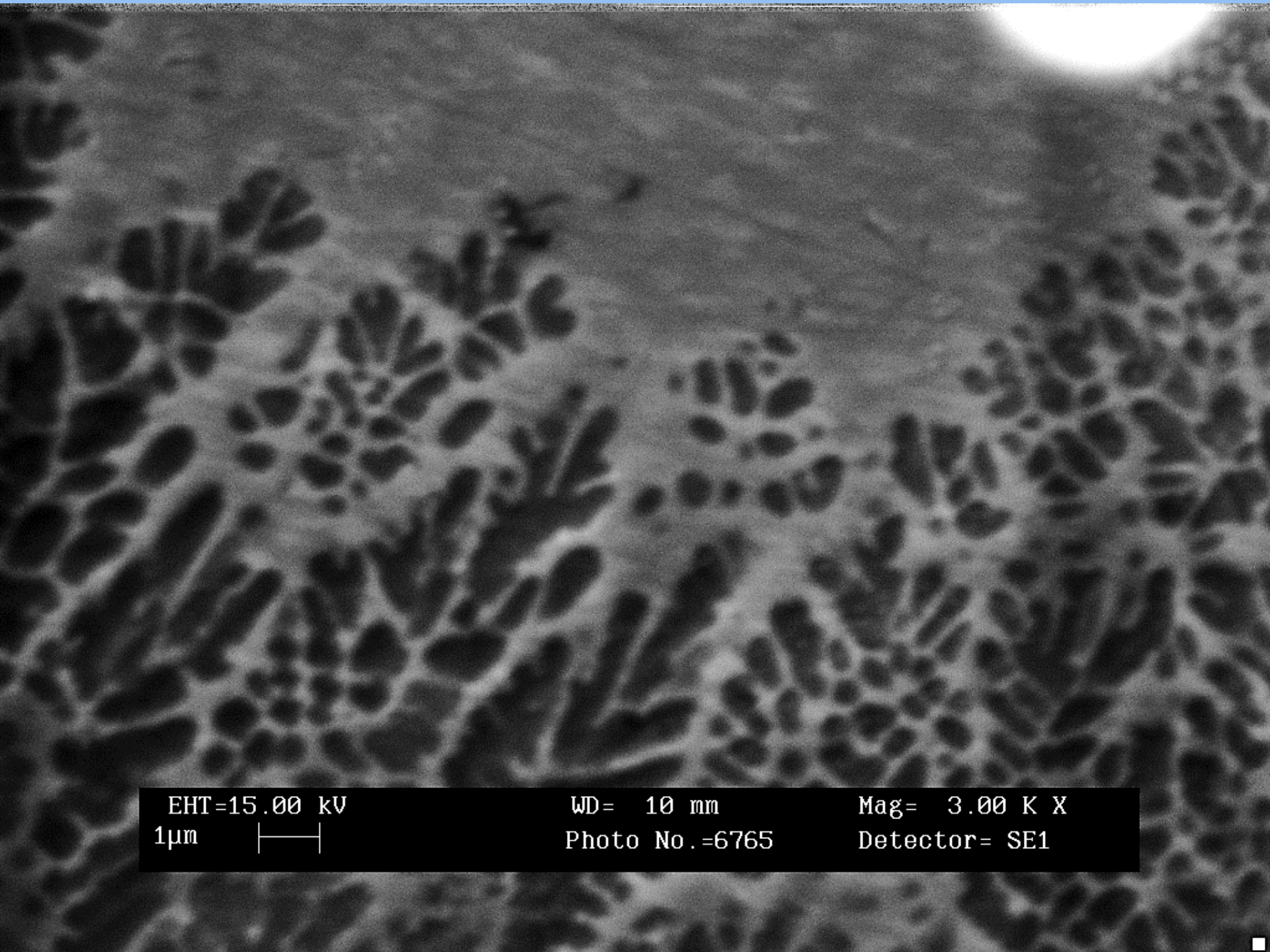


EHT=25.00 kV	WD= 2 mm	Mag= 2.07 K X
1μm	Photo No.=6733	Detector= SE1





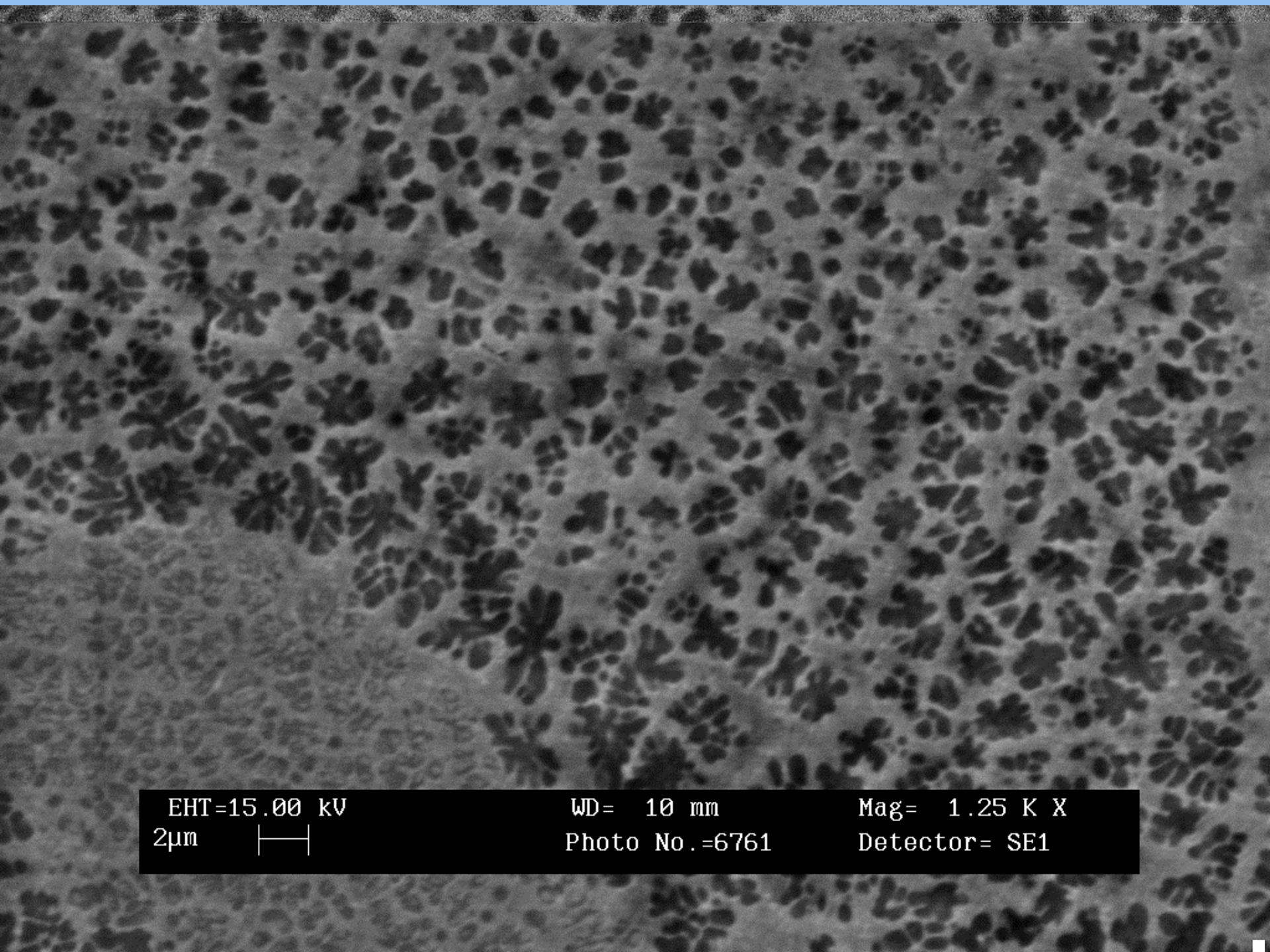
EHT=15.00 kV WD= 10 mm Mag= 2.50 K X
2μm |————| Photo No.=6768 Detector= SE1



EHT=15.00 kV
1 μ m

WD= 10 mm
Photo No.=6765

Mag= 3.00 K X
Detector= SE1



EHT=15.00 kV

2 μ m

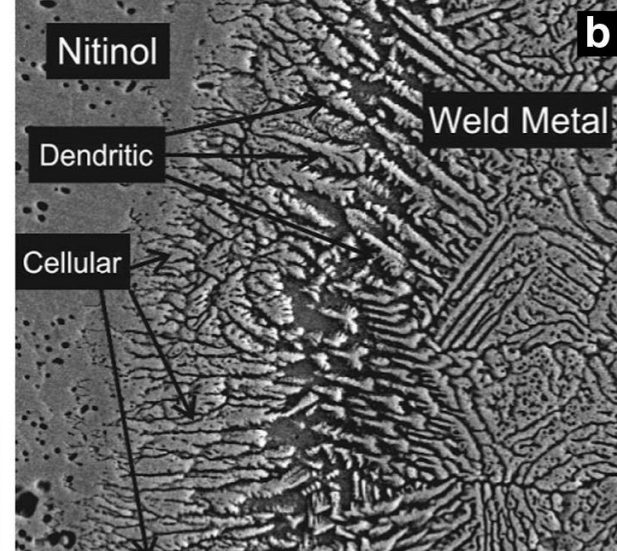
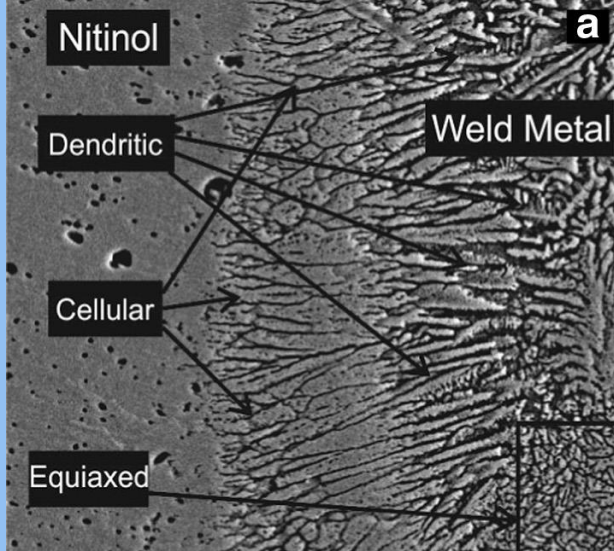


WD= 10 mm

Photo No.=6761

Mag= 1.25 K X

Detector= SE1



Zoeram and Mousavi: Laser welding of Ti-6Al-4V to Nitinol

SEM MAG: 2.00 kx
HV: 25.0 kV
WD: 13.4809 mm

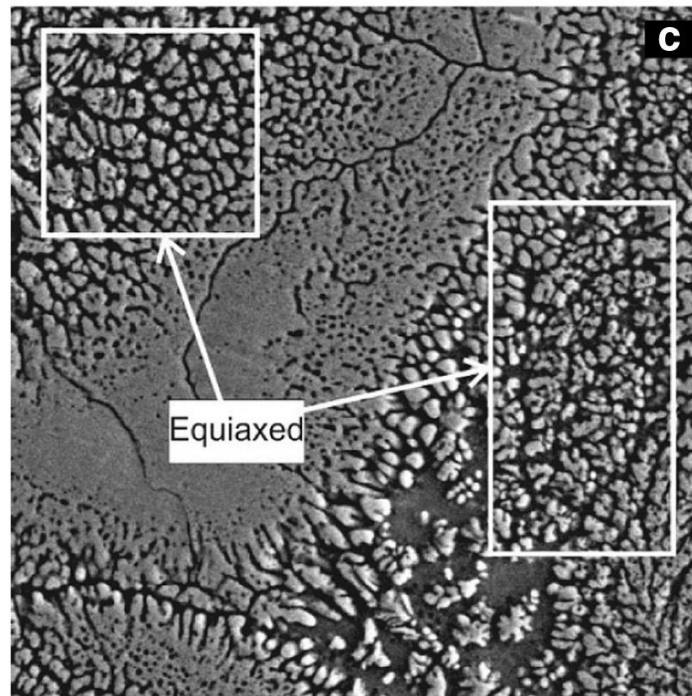
DET: BSE
DATE: 10/15/12
Device: MV2300

20 um
Vega ©Tescan
School of Metallurgy, University of Tehran

SEM MAG: 2.00 kx
HV: 25.0 kV
WD: 13.4809 mm

DET: BSE
DATE: 10/15/12
Device: MV2300

20 um
Vega ©Tescan
School of Metallurgy, University of Tehran

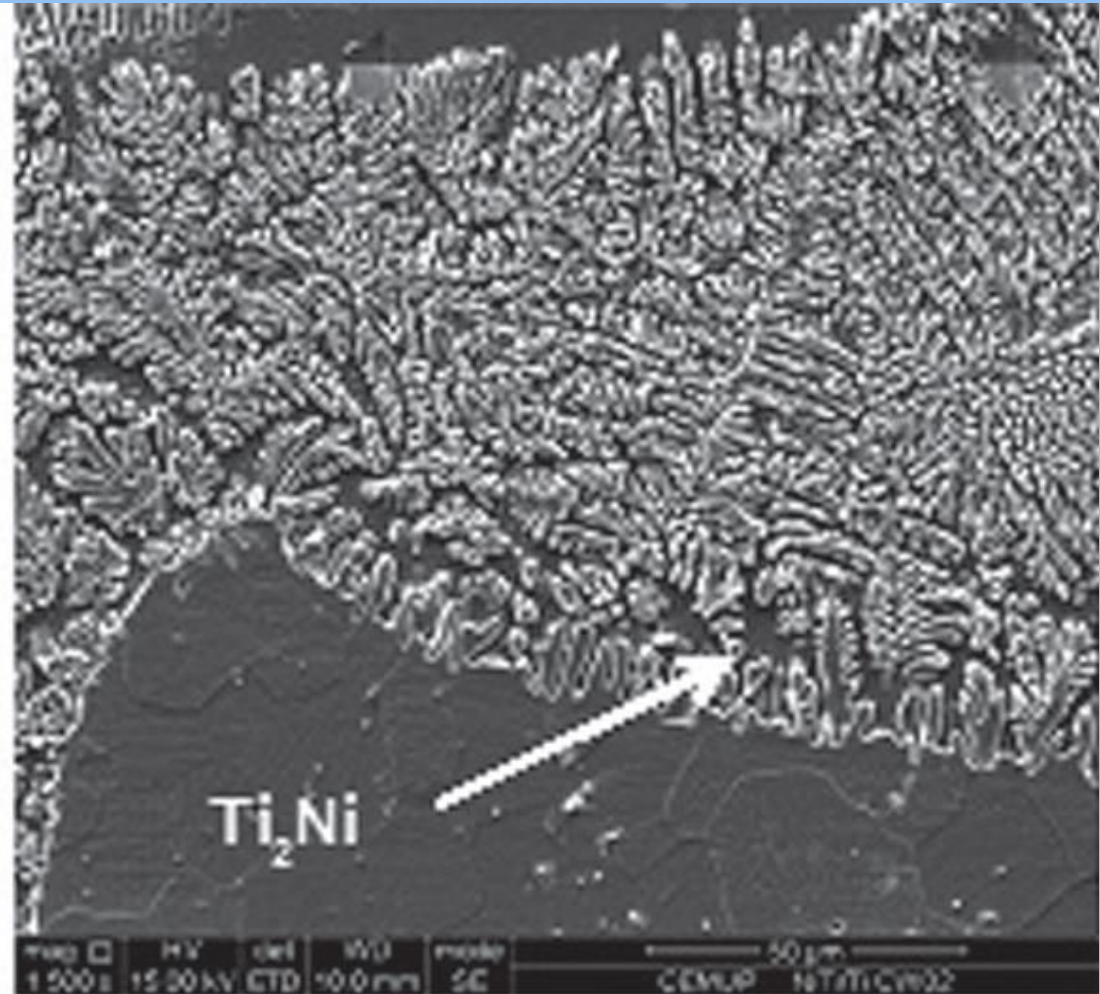
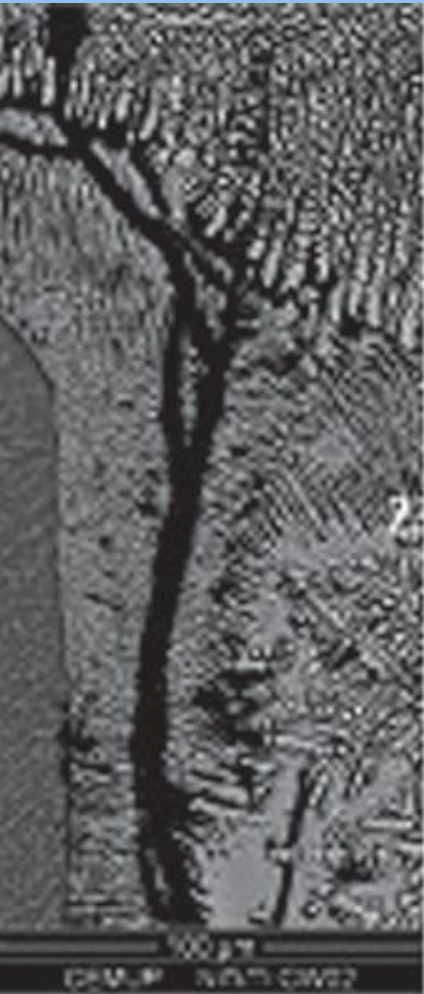


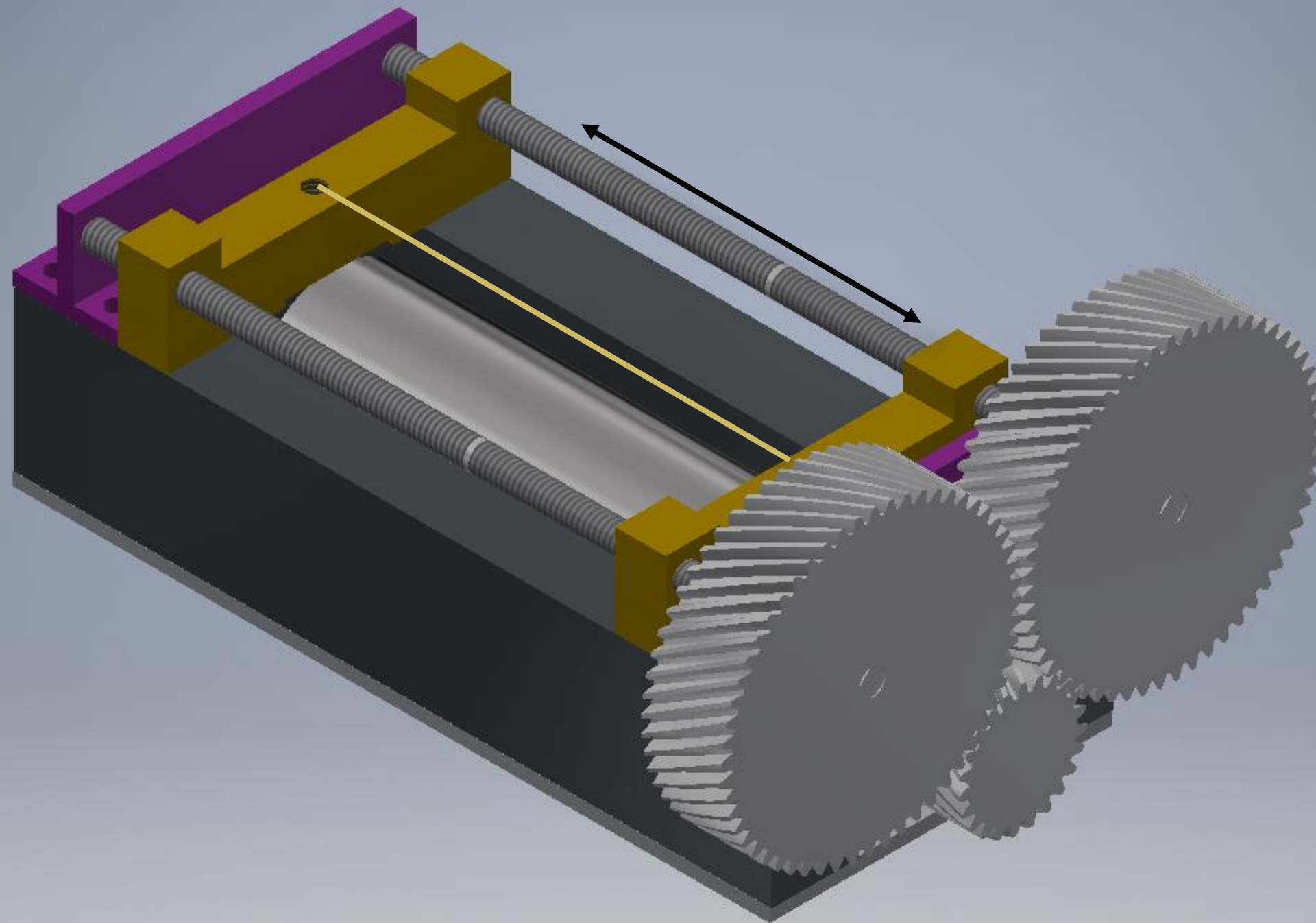
SEM MAG: 2.50 kx
HV: 25.0 kV
WD: 13.4809 mm

DET: BSE
DATE: 10/15/12
Device: MV2300

20 um
Vega ©Tescan
School of Metallurgy, University of Tehran

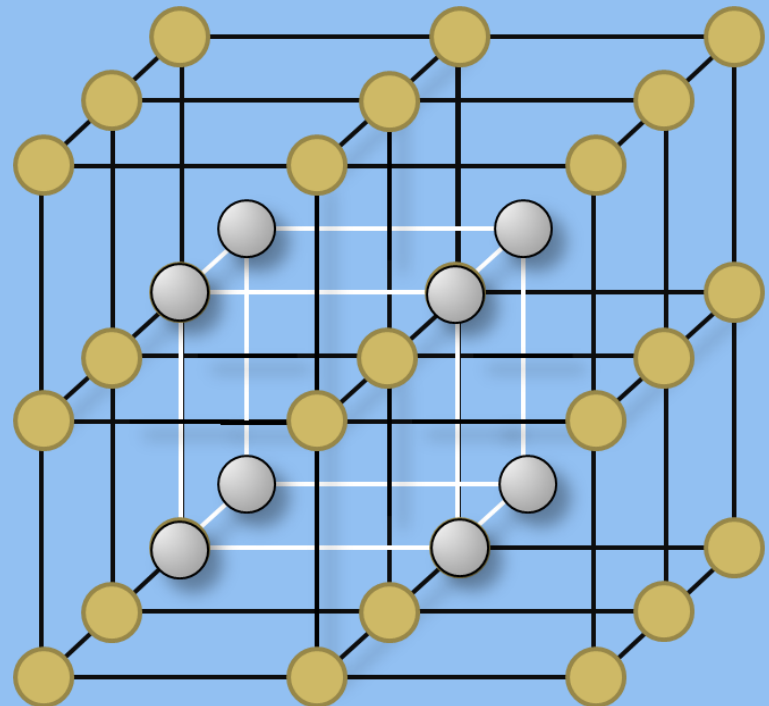
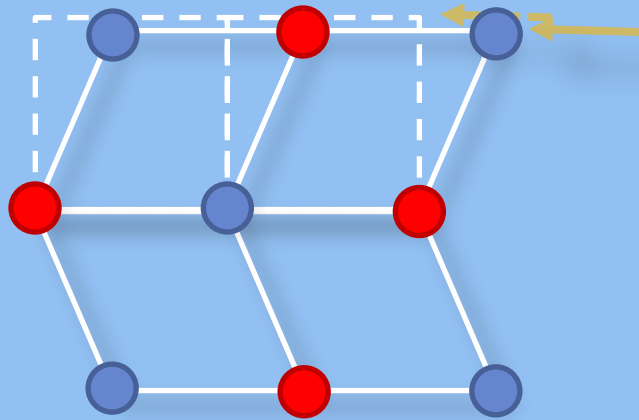
Quintino and Miranda: Welding shape memory alloys with NdYAG lasers





Future Work

- ▣ Optimize welds using interlayer
- ▣ Optimize heat treatments
- ▣ Build strain stage



References

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