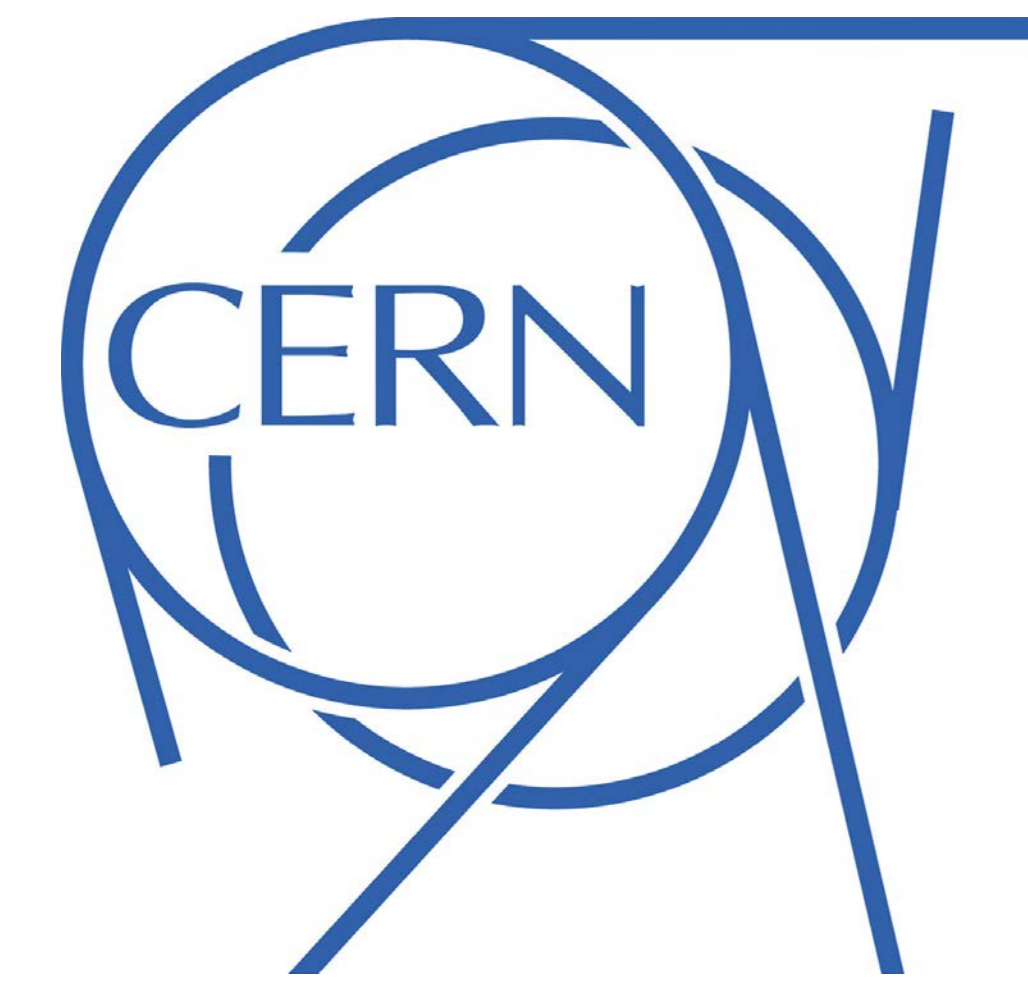


Development of conductors for thin solenoids for ultra radiation-transparent detector magnets



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Purpose and goal:

- Development of conductor for future detector magnets.
- High stress and high conductivity.
- Save resources.
- Simplify technical problems.

Possible solutions:

- Nano-doped materials: Al+CNT, Al+Graphene.
- Multi-layered composites via ARB: Al5N/AlNi + 7000 Al alloy.
- Mechanically reinforced stabilizer: Al5N/AlNi + 7000 Al alloy.

Problems:

- No industrial suppliers of nano doped materials.
- Difficult infrastructure for ARB.
- 7000 series alloy difficult to weld.

Possible welding techniques for a reinforced conductor sandwich?

- Electron beam welding:
 - +thin (~±1mm) weld
 - +no J_c degradation
 - -hot cracking
- Friction stir welding:
 - +no phase transition
 - +automatized
 - -wide weld (~±3mm)

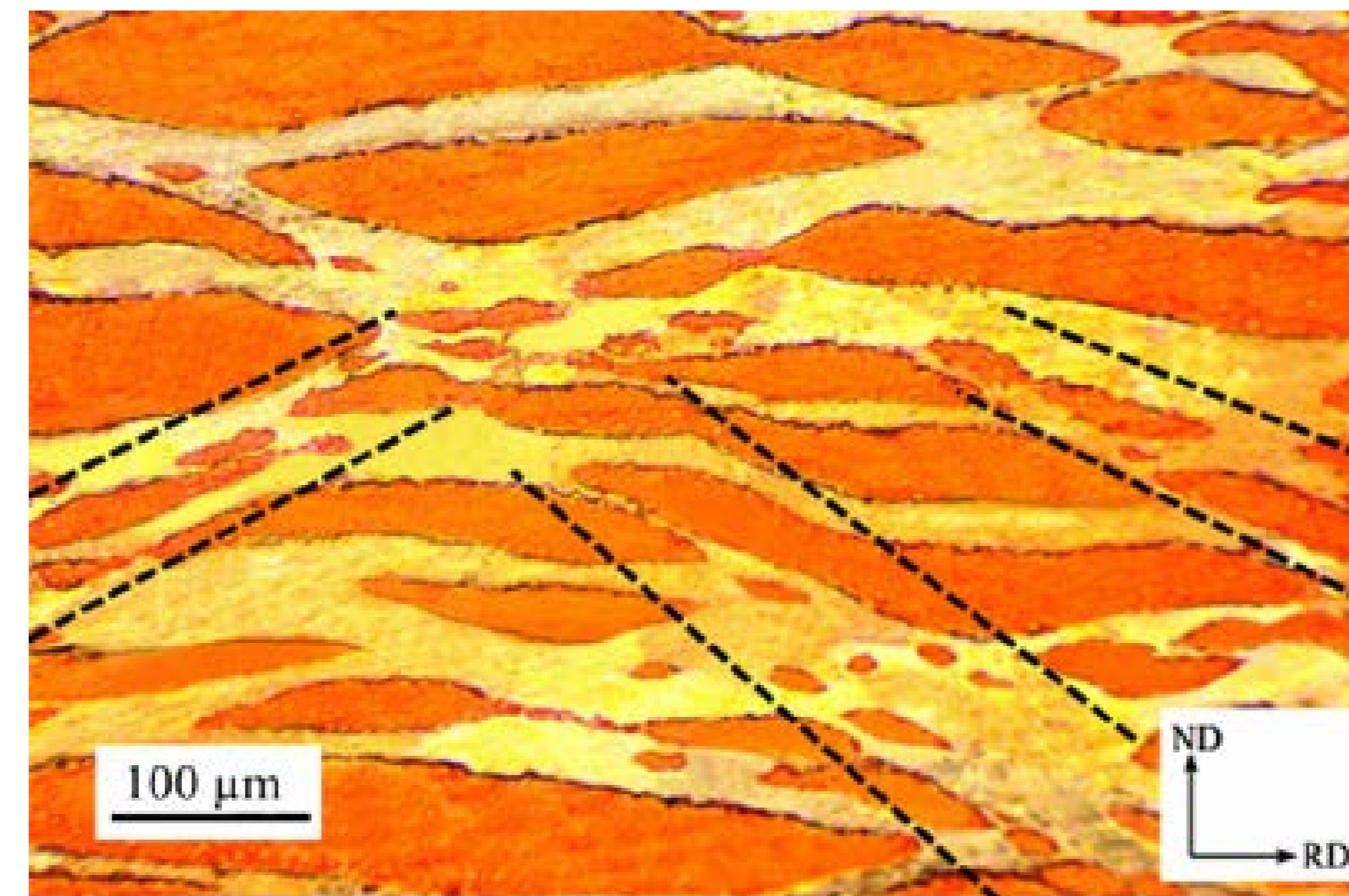
Current status and outlook:

- A welded reinforced conductor seems to be the best solution.
- A conductor satisfying the requirements was dimensioned.
- Partner for FSW found and samples will be produced.
- Small scale ARB with Al5N + 7000 Al alloy under consideration.

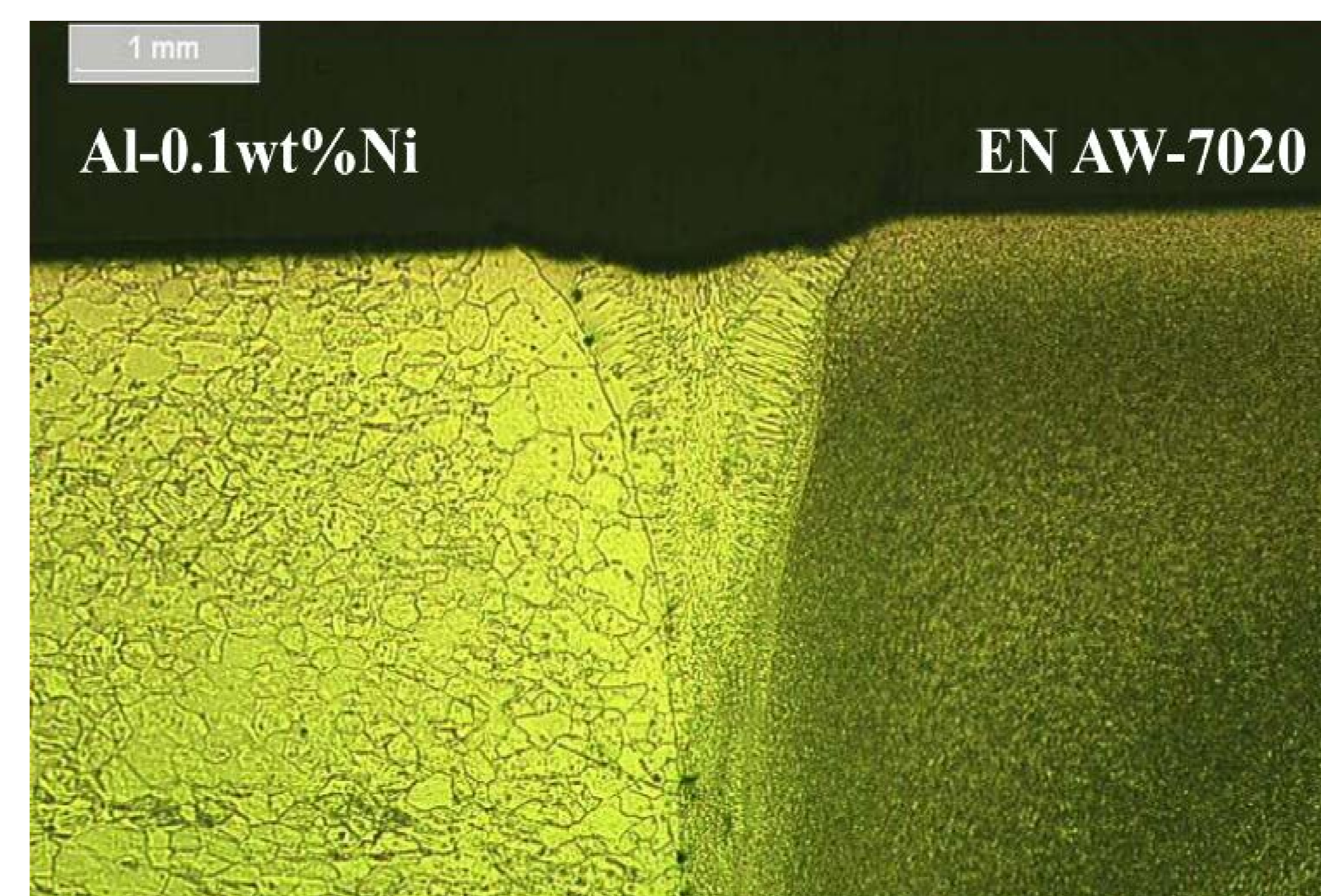
[1] V. Y. Mehr, M. R. Toroghinejad and A. Rezaeian

[2] S. Sgobba

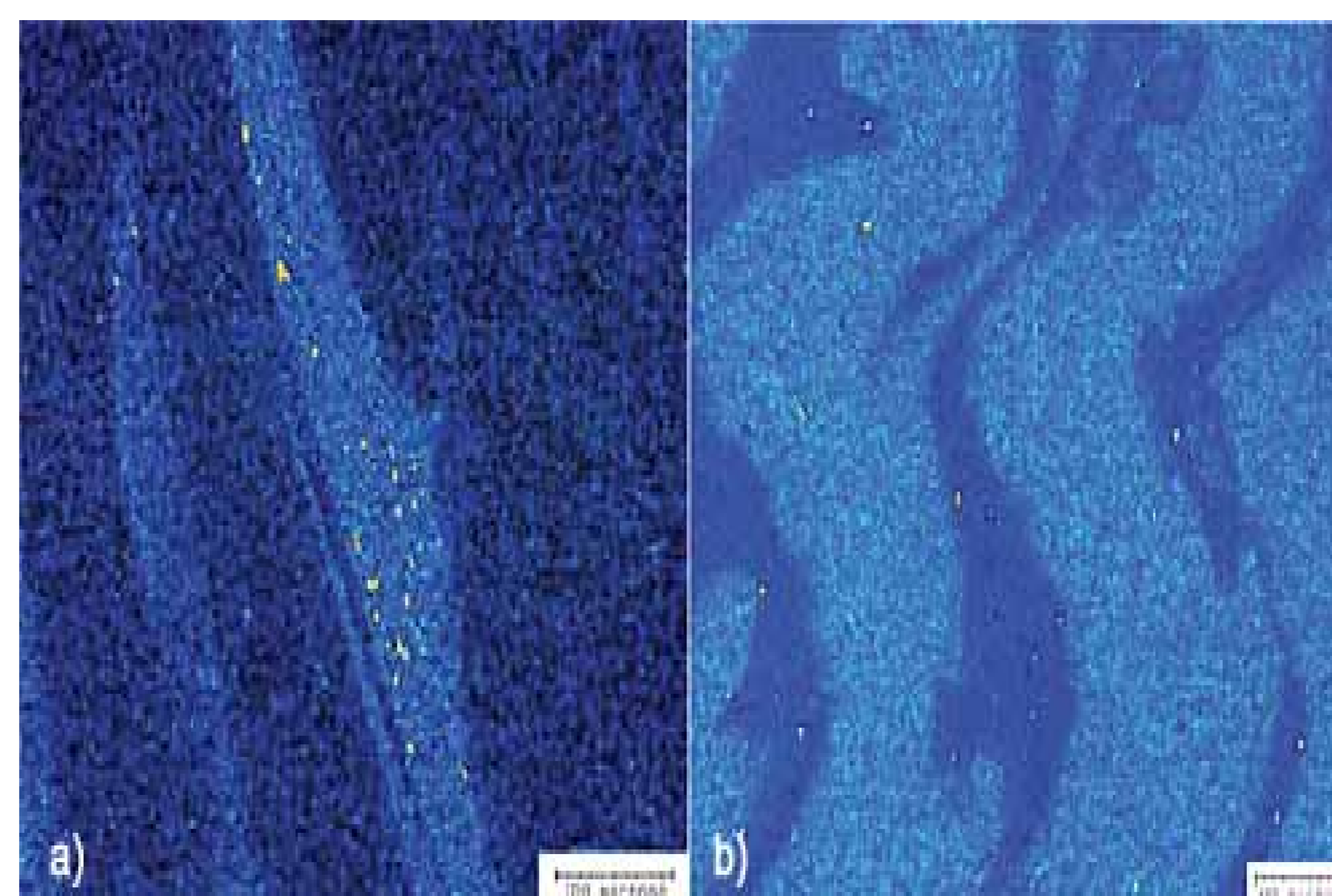
[3] P. Threadgill, A. Leonard, H. Shercliff and P. Withers



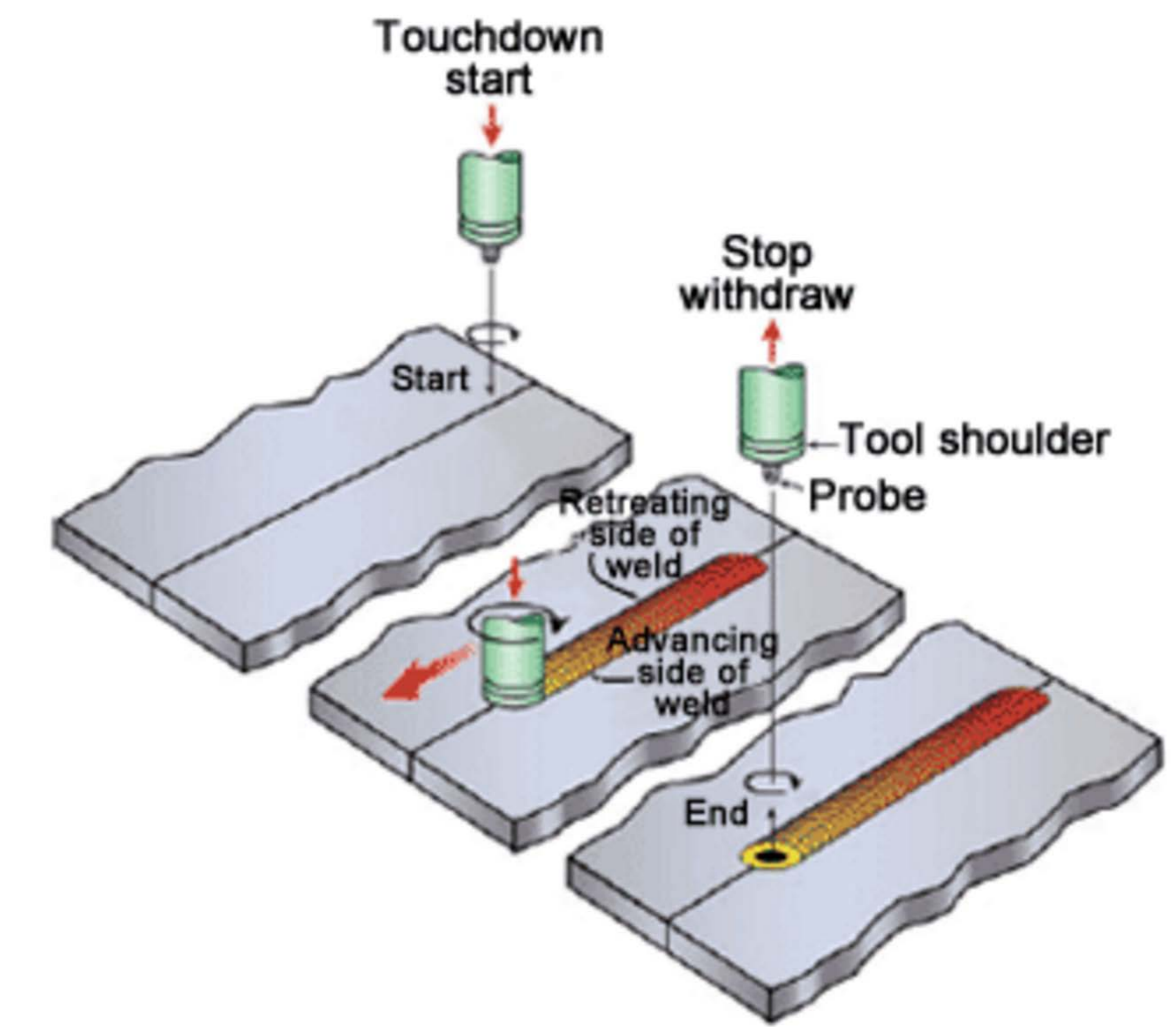
Microstructure of Al –Cu after six cycles of ARB. [1]



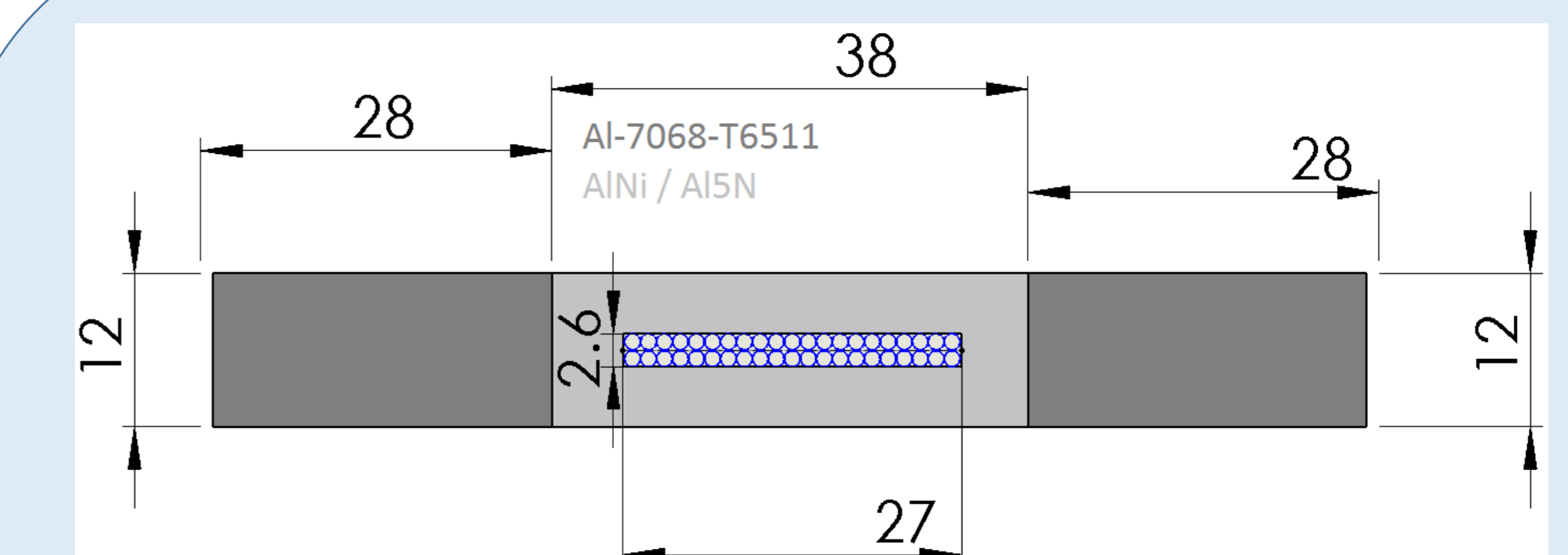
AlNi 0.1%w.t. electron beam welded to EN AW-7020. [2]



X-ray map of the nugget region of two alloys from different families. [3]



Friction stir welding. [3]



Parameter	Value	Unit
J _c NbTi	3250	A/mm ²
# of windings	830	1
Op current	38	kA
Strand diameter	1.28	mm
# of strands	42	1
Op density	1400	A/mm ²
Temp. margin	1.5	° K
Enthalpy	8	J/m
Temp. quench	75	° K
Coil thickness	1.14	X ₀

Main parameters for a sandwich conductor.