Nb_3Al Development at NIMS II

--- Cu stabilization with double stacking ---

N. Banno (NIMS)

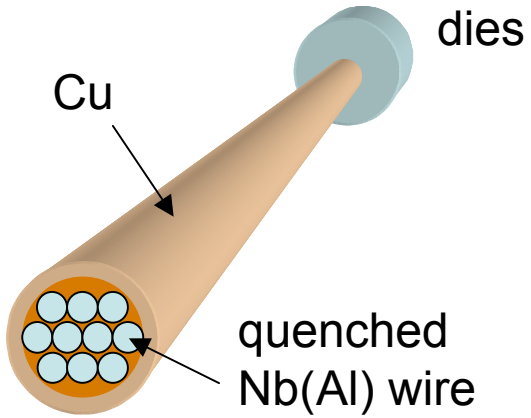
T. Takeuchi, A. Kikuchi (NIMS)
K. Tagawa (Hitachi Cable)
K. Tsuchiya, A. Yamamoto (KEK)

Background

for Cu stabilization

- Ion-plating & electro-plating
  - → Long length fabricability
  - → but, might require cost

- Another simple technique
  - → Double-stacking method

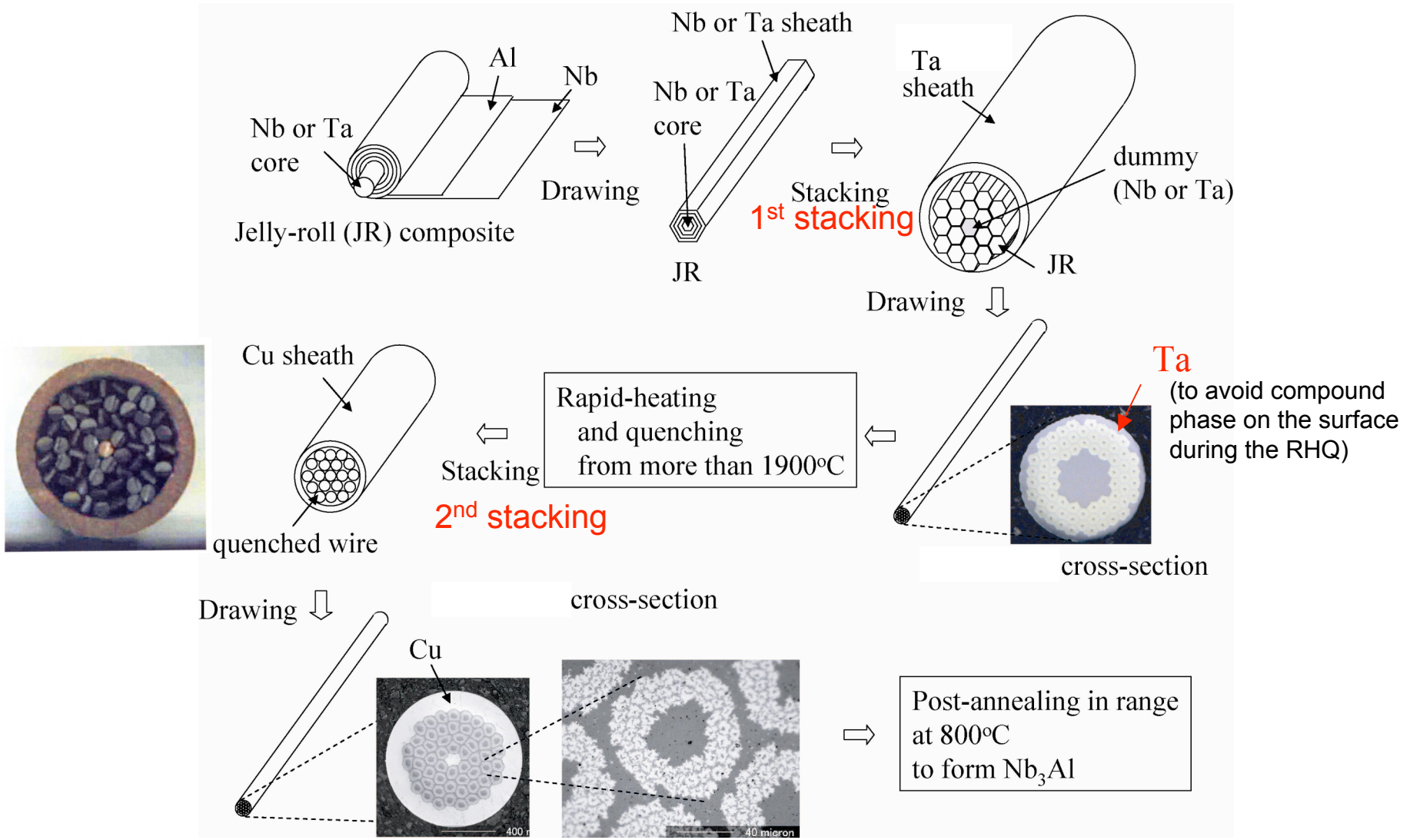


How to make?

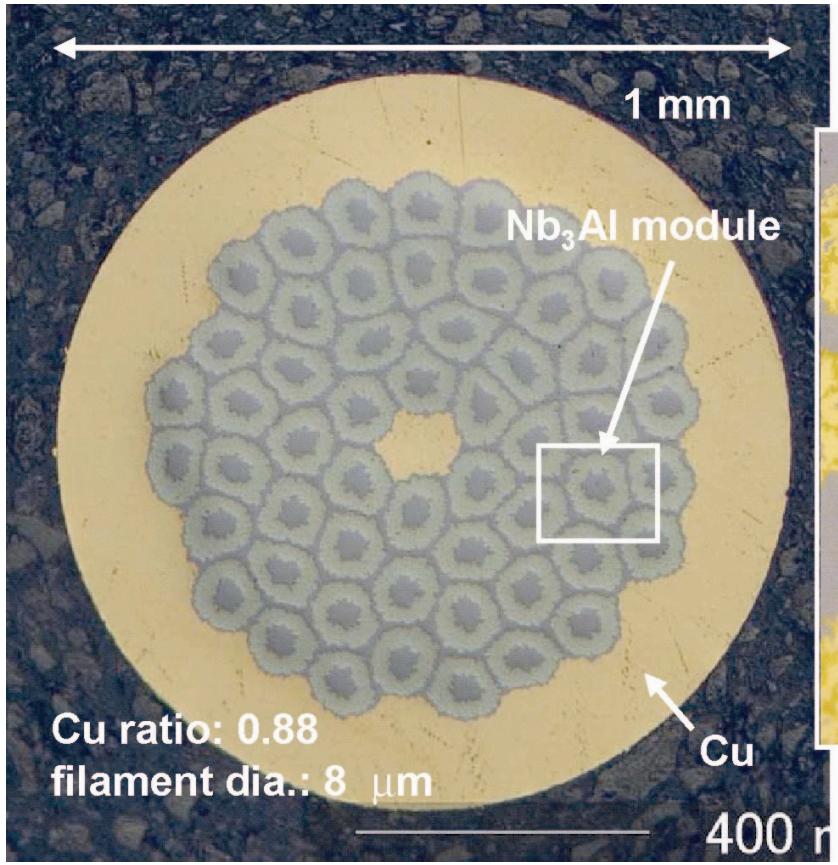
→ re-stack the quenched Nb(Al) solid solution wires into a Cu tube, and cold-draw it through normal dies

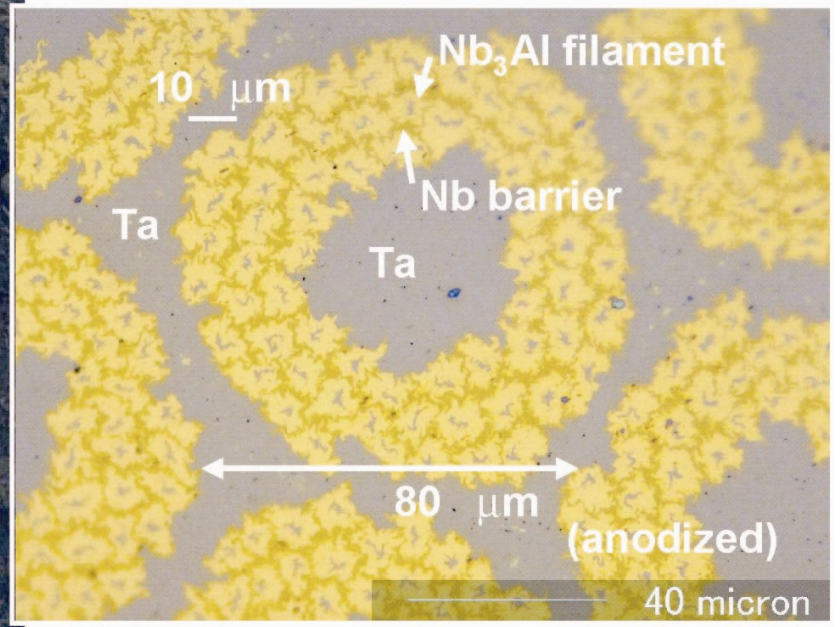
This method is based on the good ductility of the quenched Nb(Al) phase.

Diagram for fabrication



Developed wire

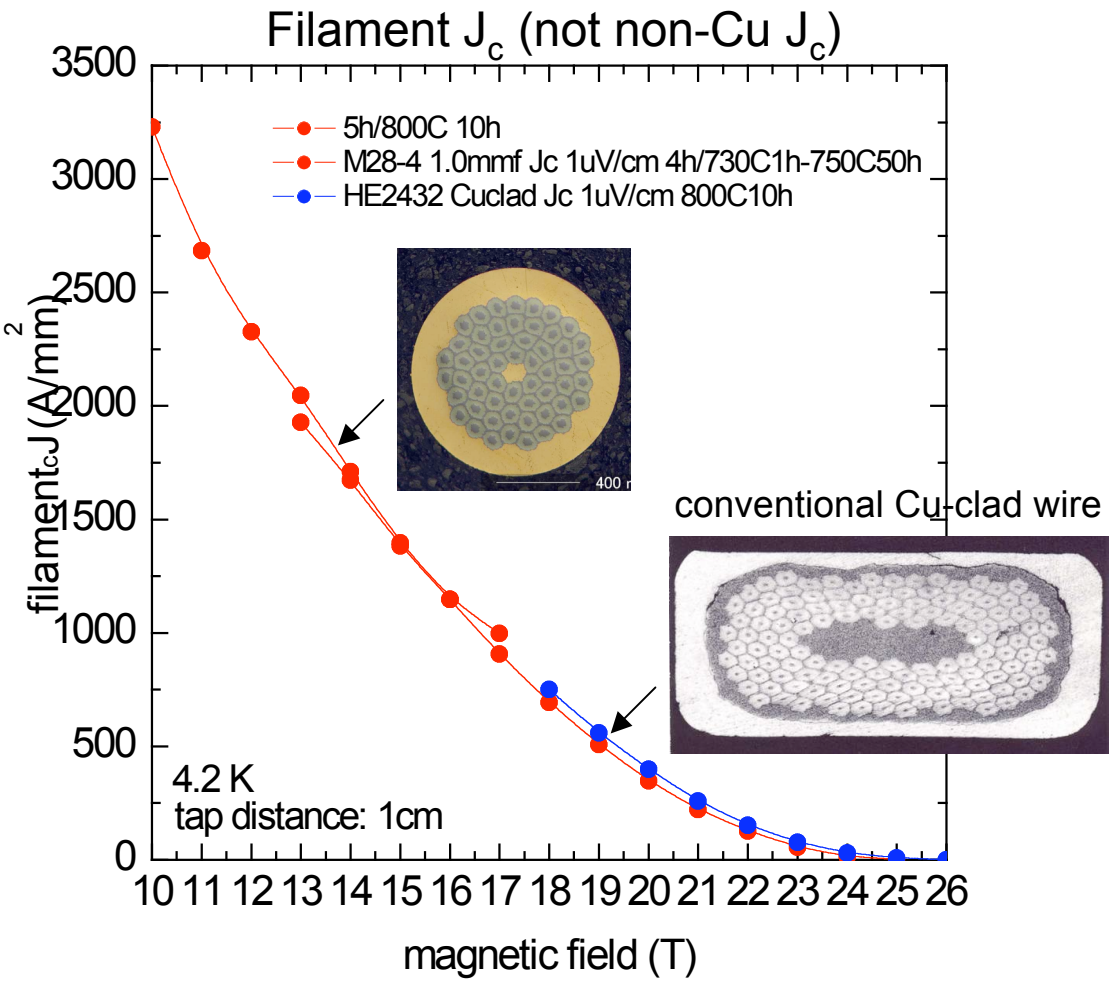




- Cu ratio: 0.88
- filament diameter: 8 μm
- bend strain limit: 0.8%
- fabricated length: 20 m

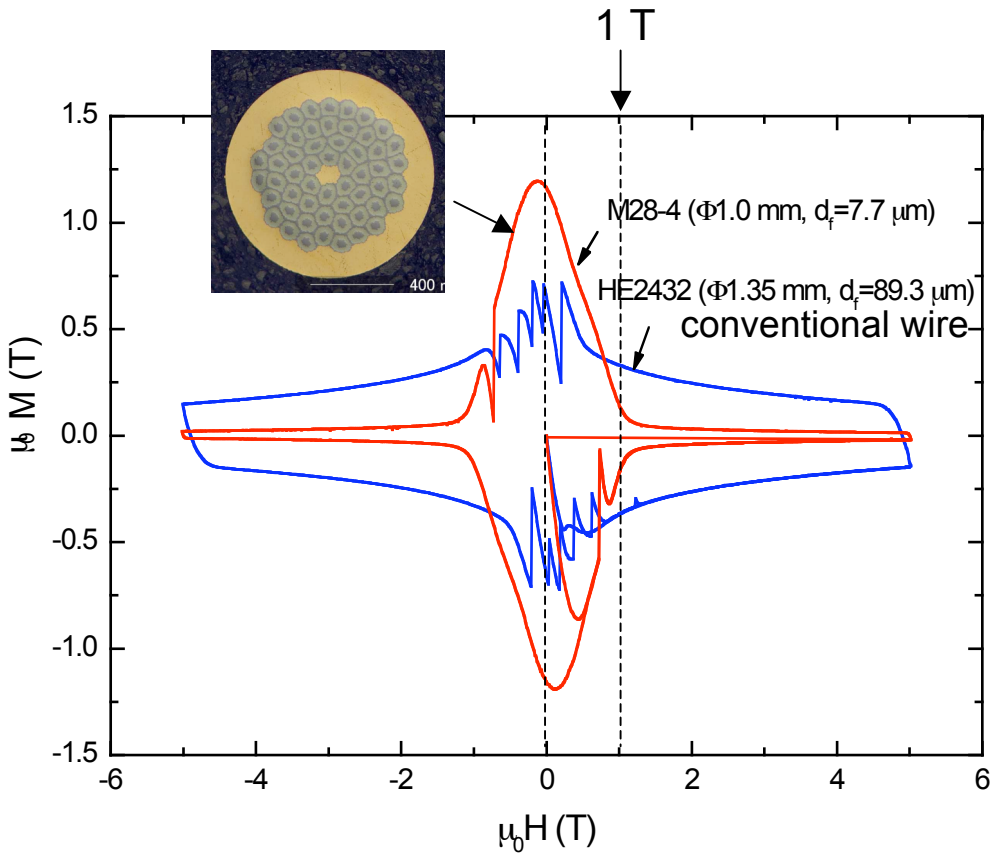
Characteristics

1. J_c – B characteristics



Characteristics

2. Magnetization



SQUID measurement

- B > 1 T

  M → 1/10

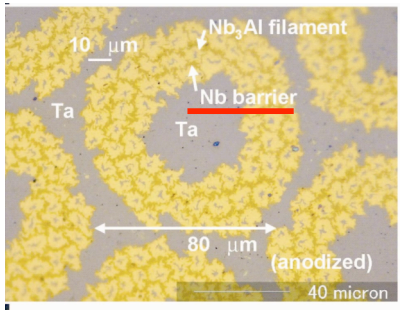
  because of reduced d_f

  (d_f has been reduced to 1/10)

- B < 1 T

  M is still high,

  because of Nb barrier.



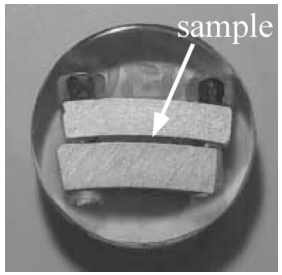
→magnetic coupling

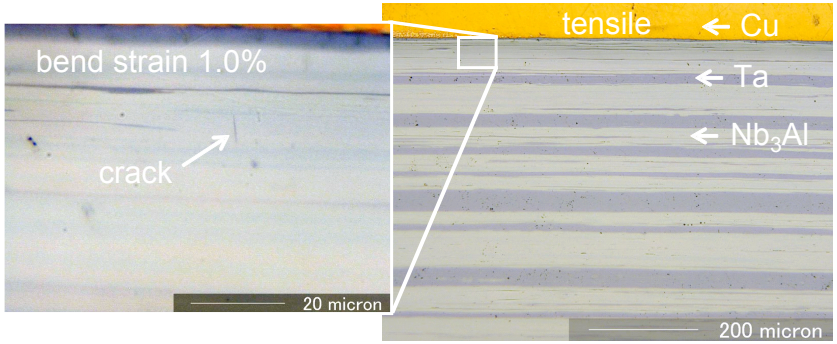
→Increase of effective filament diameter

Characteristics

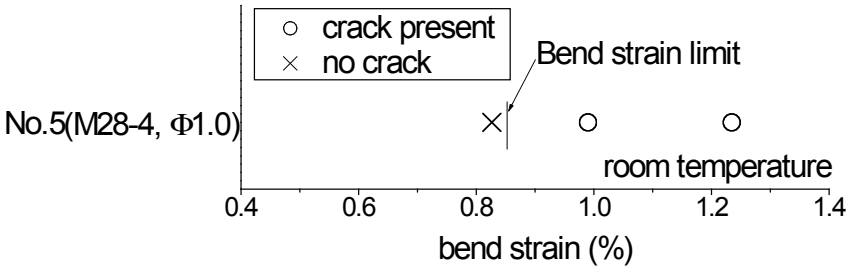
3. Bend strain tolerance

- Crack observation





- Bend strain limit

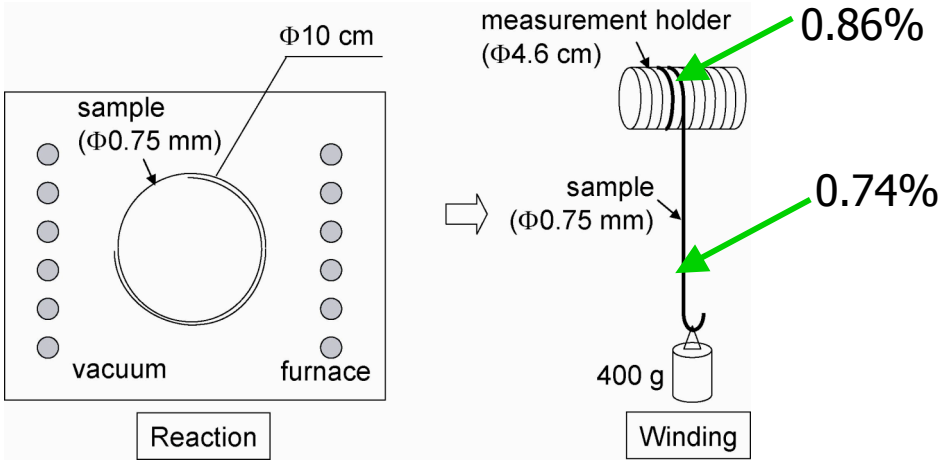


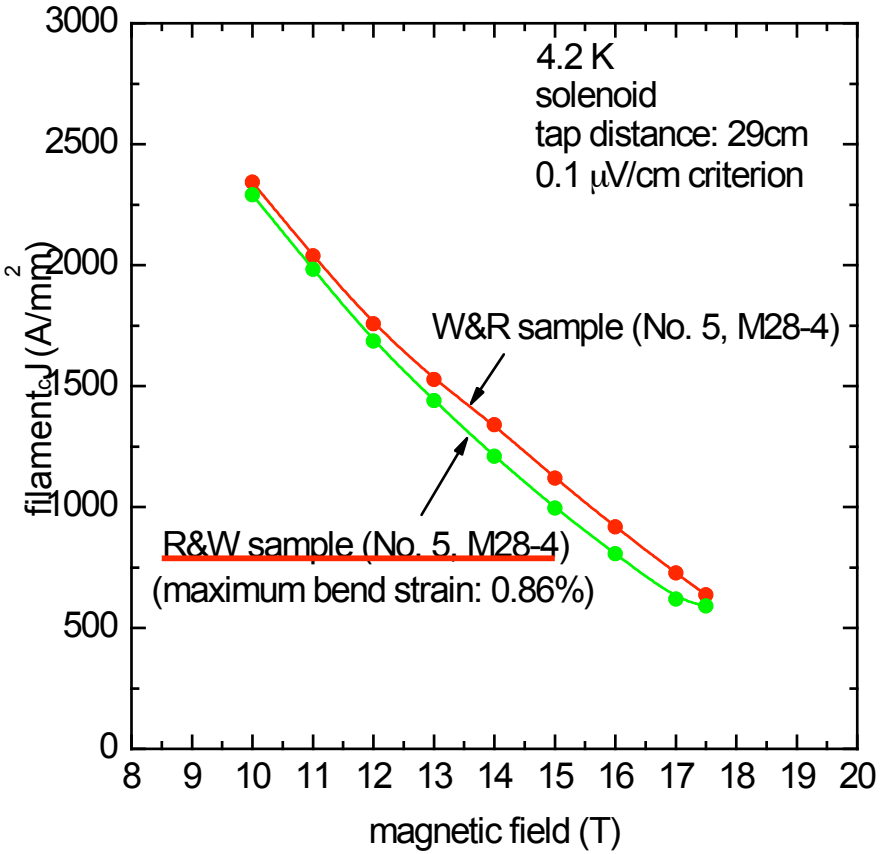
Tolerable bend strain : ~ 0.85%
(conventional wire : ~ 0.3%)

Characteristics

4. React & wind test

- applied bend strain





Summary

1. Cu is attached strongly by additional cold-drawing through normal dies.

2. The J_c – B characteristics of the wire is compatible to that of the conventional Nb_3Al wire.

3. The magnetization can be more reduced, if all the matrix is replaced by Ta.

4. The react & wind technique is applicable on this wire, up to about 0.8% bend strain, without J_c degradation.

Next objectives

1. Fabrication of all Ta matrix wire to suppress low-field instability under 1 T
2. Fabrication of long length wire more than 100 m

References

1. N. Banno, T. Takeuchi, H. Kitaguchi, and K. Tagawa,
   "Strain tolerance in technical Nb_3Al superconductors",
   Supercond. Sci. Technol., vol. 19, no. 10, pp. 1057-1062, 2006

2. N. Banno, T. Takeuchi, H. Kitaguchi, K. Tagawa, Y. Iijima, and A. Kikuchi,
   "Relationship between BCC-deformation, transformation temperature and microstructure in Nb_3Al wires",
   IEEE Trans. Appl. Supercond., vol. 17, 2007, in press