

Development of New Flexible Compound Superconducting Wires



Keywords: A15 Typed Compound (Nb_3Al , Nb_3Sn), Wire Processing, Large Critical Current Density, Flexible Strand Cable

Akihiro Kikuchi

Electric and Electronic Materials Field / Low-Temperature Superconducting Wire Group
KIKUCHI.Akihiro@nims.go.jp | https://samurai.nims.go.jp/profiles/kikuchi_akihiro



Background

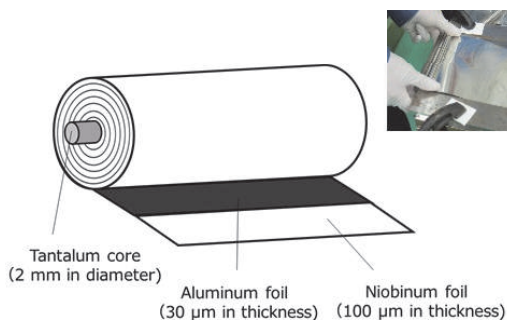
- Present main practical superconducting wire is NbTi alloy, because it shows good handling due to its flexibility.
- Therefore, the performances of superconducting application devises have been limited by the critical parameters of NbTi wires ($T_c=10K$, $B_{c2}@4.2K=10T$).

Aim

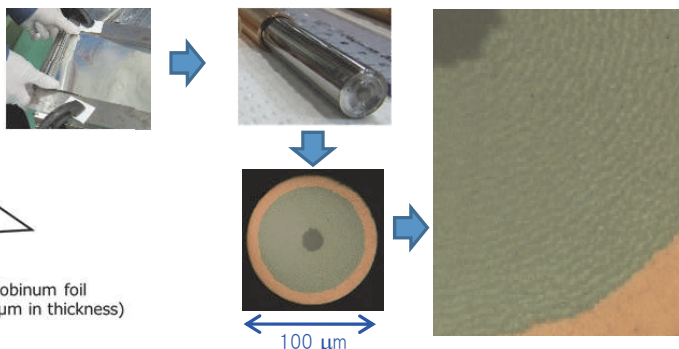
- A15 compound superconductors have two times higher T_c and B_{c2} than NbTi.
- In addition, Nb_3Al shows an excellent strain tolerance and is expected to apply the react & wind technique for the coil fabrication.
- Pushing the R&D for new low cost conductor having both high critical current density, J_c and flexibility.

Advanced Research Topics

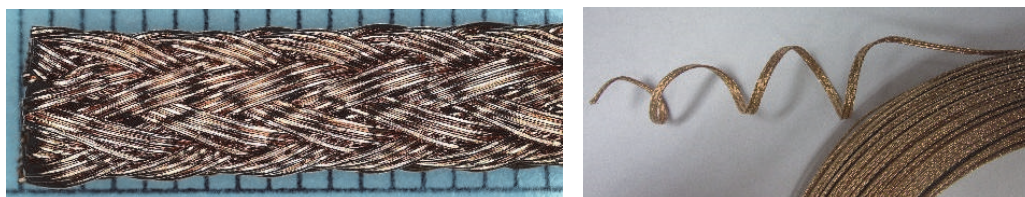
Jelly-Rolled Composite Process



Super Fine Wires with less than 1.0 mm in Diameter



Brookhaven Typed Flat Braid Wires (Flexible Strand Cables) ※ Image



Publications

- Akihiro Kikuchi, "Looking Back for Research and Development of Nb_3Al Wires - Facing a Turning Point- ", TEION KOGAKU (J. Cryo. Super. Soc. Jpn.), Vol/ 53 (2018) p.p. 27-34. (in Japanese)

Applied area and future prospects

- SMES, MRI, NMR, Maglev Train, High Energy Accelerator, Fusion Reactor, and etc.
- Replacement of NbTi Magnets.
- High Field Superconducting Magnet through the React & Wind Technique.

Issues for technology transfer

- Improvement of the critical current density.
- Establishment of the fabrication technology for super fine wires with several tens to hundreds in piece length.
- Optimization of the cross-section design of the flexible strand cables.