

Appearance and Features of Next-generation Superconducting Coil

1 Appearance of next-generation superconducting coil

<Coil shape>

Outer diameter 280 mm × Height 25 mm

<Coil performance>

Conduction current: 1,500 A or more @4.2K

Maximum magnetic field in the coil: 10T

Coil magnetic field stress: 1,700 MP or more
(10 times the conventional result)



<Insulating coating>

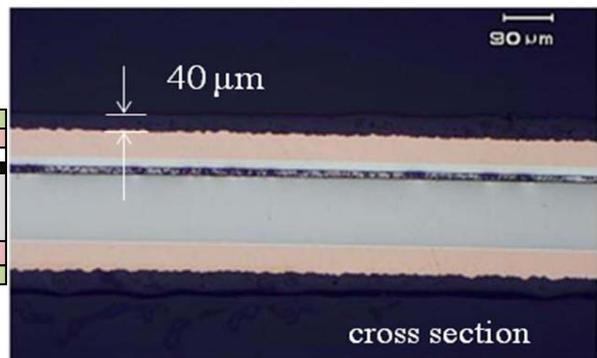
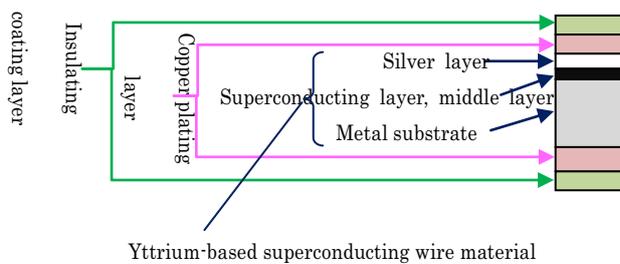
Insulating resin: Cold-setting modified polyamide resin

Coating layer thickness: 40μm

Insulation performance: 10 kV / 25μm (AC.BD)

Thermal conductivity: 2 W/m K

(10 times the conventional insulating coating)

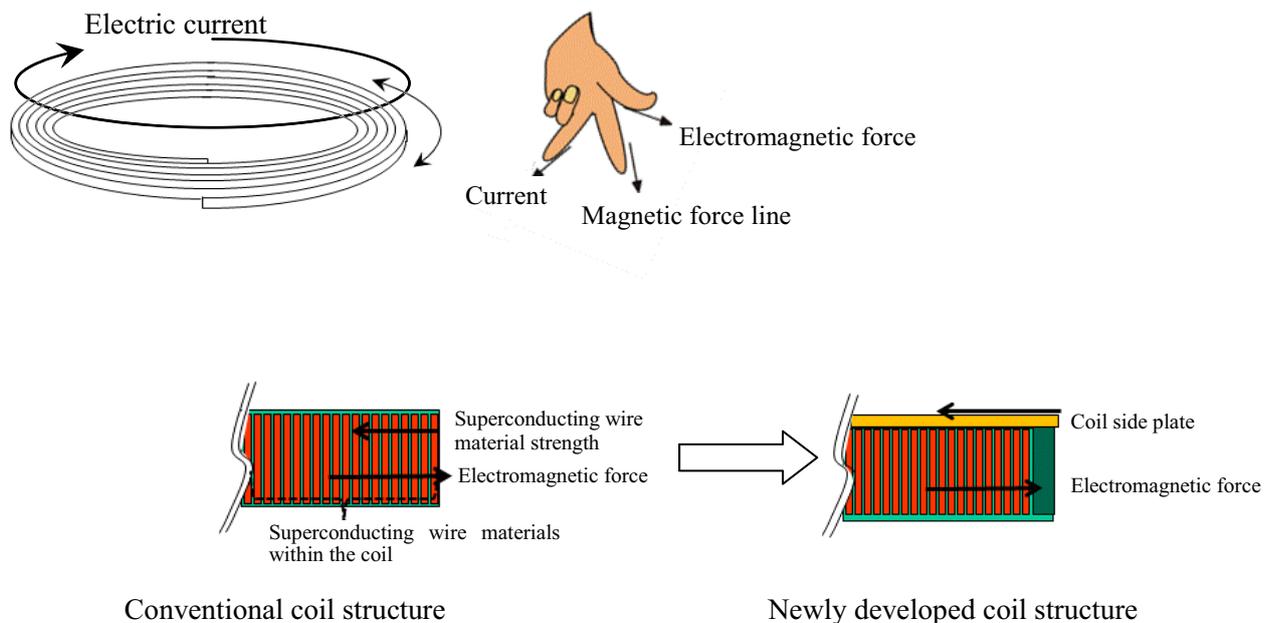


2 Features of next-generation superconducting coil

(1) High-strength coil structure

When a large current is flowed to a superconducting coil to generate a strong magnetic field, strong electromagnetic force (hoop force) works to elongate the superconducting wire materials. When this hoop force exceeds the strength of the superconducting wire materials, the coil breaks.

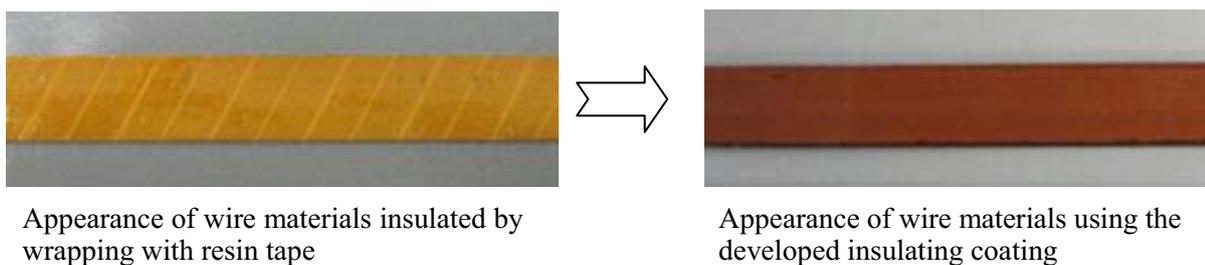
This development supports the electromagnetic force acting on the superconducting wire materials using a side plate in the direction of the coil surface. This enabled the coil to withstand electromagnetic force in excess of the limit strength of the superconducting wire materials.



(2) Insulating coating technology using liquid resin

Conventional insulation by wrapping resin tape had various issues, such as resin tape gaps or unevenness that lowered the insulating performance when bending wires into coils or other shapes, and an uneven superconducting wire material surface that adversely affected processing. On the other hand, the enamel-type coating often seen on electric wires has a high hardening temperature, which affects the characteristics of yttrium-based superconducting wire materials, so it could not be used.

This development resolved the above issues by using liquid resin that can harden at a temperature that does not adversely affect the superconducting characteristics.



Appearance of wire materials insulated by wrapping with resin tape

Appearance of wire materials using the developed insulating coating