**I. Introduction**

To apply the Ni techniques:
- We need to understand:
  - transient stability and thermal properties
  - electrical and mechanical properties
  - behaviors of current bypassing into the transverse direction

**Purpose of the metallic protection ring**

The metallic protection rings installed on the outermost turn of Ni coil are proposed to improve the thermal, mechanical and electrical stabilities of Ni coils.

![Schematic drawing of the current transportation coil](image)

**II. Effects of the metallic protection rings**

**Mechanical stability**
- During the cooling process to bath temperature
- During the process returning to room temperature
  - support the mechanical shrinkage
  - suppresses the thermal expansion

**Electrical and thermal stabilities**
- Generated normal zone
- Current bypassing into the inner metal ring

**III. Electrical and mechanical properties by metallic protection rings (Cu tape)**

**A. Experimental details**

The metallic protection ring to improve the electrical and mechanical stabilities of Ni HTS coil was suggested, however in this study, the electrical effectiveness of the metallic protection ring will be discussed using wrapped by 8-turns Cu tape around the outermost layer of test coil.

**Specifications of 2G wire and Cu tape**

<table>
<thead>
<tr>
<th></th>
<th>2G wire (Cu tape)</th>
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<tbody>
<tr>
<td>Width (mm)</td>
<td>4.1</td>
</tr>
<tr>
<td>Thickness (μm)</td>
<td>234</td>
</tr>
<tr>
<td>Stabilizer thickness (μm)</td>
<td>45 ± 2 (Brass)</td>
</tr>
<tr>
<td>Critical current (A)</td>
<td>180 (at L. N.)</td>
</tr>
</tbody>
</table>

**B. Transient property by Cu tape**

(Instead of the metallic protection rings)

- Voltage profiles and self-magnetic field: Heater3, 6 W input and 80 A

- There was no current bypassing into the Cu tape.
- Magnitude of the generated voltages in the longitudinal direction
  - without Cu tape coil < with Cu tape coil
- Reduced the both self-magnetic field are 50 G
  - (5 turns)

**C. Current bypassing characteristics by Cu tape**

**D. Characteristics by thermal cycle (with Cu tape coil)**

- Test coil was cooled by L. N. → 1st measurement
  → test coil was returned to room temperature → 2 weeks later
  → cooled by L. N. → 2nd measurement → returned to room temperature → 2 weeks later → cooled by L. N. → 3rd measurement

**IV. Conclusions**

- The metallic protection rings to improve the electrical and mechanical stabilities of Ni HTS coil are suggested.
- The Ni test coil with Cu tape instead of a metallic protection ring was prepared and experimentally investigated.
- It is expected that the generated hot spots in the outermost region of Ni HTS coils can be suppressed.
- Now we are starting to measure with metallic ring,...