# A Properties Measuring System for HTS Wires

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Twenty years have passed since the discovery of the phenomenon of high-temperature superconductivity. Studies have now shifted away from basic research and are focusing on the field of application. At the same time, remarkable progress has been in the field of high-temperature superconducting (HTS) wires made of rare earth (RE) coated materials featuring high values of critical current in the environment where the temperature is higher and the magnetic field is stronger than ever.

In this context, the Railway Technical Research Institute (RTRI) has started a study on the application of RE coated wires to HTS magnets for the magnetic levitation railway system (maglev system). In this study, it is important to examine thoroughly the properties of the wire to be used and reflect them in the design of superconducting magnets. Therefore, the RTRI has developed an HTS wire testing device to evaluate the conductivity characteristics of HTS wires in detail under arbitrary temperature and magnetic field conditions.

Figure 1 shows a schematic diagram of the device. It is constructed so that a specimen holder housing a sample wire can be inserted into the magnetic field generated by a superconducting coil. The sample wire, an actual 100 mm-long superconducting wire, can be cooled down to about 10 K degrees by a two-stage GM refrigerator or kept at an arbitrary temperature over 10 K degrees with a heater. The sample wire can be loaded with a maximum current of 1,000 A and a magnetic field up to 5.5 T in a direction selected from five angles. To ensure a stable low-temperature environment, the sample space is covered with a radiation shield cooled by a one-stage GM refrigerator and housed in a vacuum vessel supported with an adiabatic member. Table 1 shows the principal specifications of the device.

Figure 2 shows an example of the test results with a commercially available HTS wire, which illustrates the value of critical current in three dimensions with the set temperature and the strength of loaded magnetic field as parameters. Through this study, the RTRI has confirmed that the properties of the temperature and the magnetic field at the critical current can be realized by using an actual wire.

The RTRI will now use this device to evaluate the properties of different superconducting wires and utilize the knowledge thus obtained to discuss the applicability of RE coated wires to the superconducting magnets for the maglev system.

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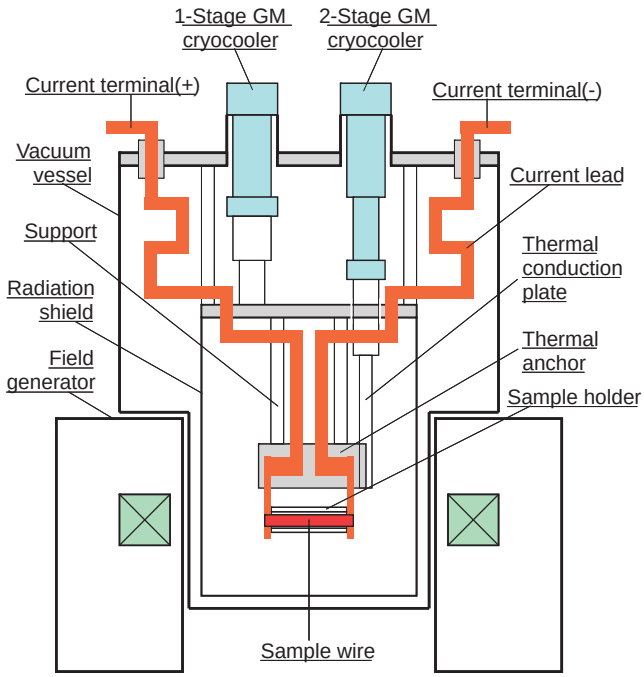


**Fig. 1** Schematic diagram of properties measuring system for HTS wires

**Table 1** Specifications of properties measuring system for HTS wires

| | |
|---|---|
| Current | 0 ～ 1000 A |
| Temperature | 10 K ～ |
| Magnetic field | 0 ～ 5.5 T |
| Sample length | 100 mm（electrodes distance of holder） |
| Field angle | 0˚, 30˚, 45˚, 60˚, 90˚（c-axis） |

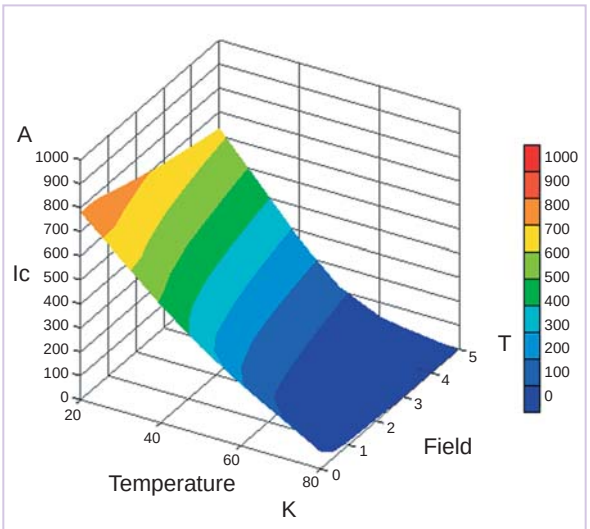


**Fig. 2** Test result of Ic profiles on temperature and magnetic field for a commercial HTS wire (B⊥c-axis)