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# The critical properties and AC loss characteristics of the developed ultra-fine and flexible Nb3Al superconducting wires

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Nb3Al has better the strain properties than that of Nb3Sn, but it is difficult to manufacture as a wire. In recent years, a research group of the National Institute for Materials Science (NIMS) in Japan has developed a new shape of ultra-fine and flexible Nb3Al superconducting. Jelly-rolled Nb/Al composite monofilamentary wires with an outer diameter of 30 μm, and multi-strand wires were successfully fabricated. In this jelly-roll process, Ta or Nb core is wrapped by a thin foil of Nb and Al and then inserted into a copper tube. The copper tube was drawn and then annealed at below 1000℃. The critical temperature of fabricated Nb3Al wire is higher than that of NbTi wire, and it has an excellent flexibility that allows winding by React & Wind method, so it can be expected to be applied to the superconducting applications cooled by conduction cooling method.
On the other hand, the heat transfer and cooling capacity characteristics by conduction cooling are significantly different from the pool cooling method by liquid helium. Therefore, in order to apply the developed Nb3Al superconducting wire to superconducting applications cooled by the conduction cooling method, it is necessary to evaluate the critical properties and the AC loss characteristics under conduction cooling operation. In this study, we have developed a measurement method that can accurately measure the critical properties considering the heat transfer characteristics of the Nb3Al sample wire in the conduction cooling operation. We prepared the single and multi-strand Nb3Al sample wires with different outer diameter (30 - 80 μm) and number of strand (7 -19 strand). The temperature (4.5 K -14 K) and magnetic field (0 T -6 T) dependence of the critical current of developed Nb3Al sample wires were experimentally examined and measured the AC loss characteristics in the conduction cooling will be presented.

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