## AP3-4-INV

# Development of Test Device for Aluminum Metal Melting by Induction Heating Using DC HTS Coils

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Aluminum die-casting technology is widely applied for the production of industrial parts such as automotive parts, since it can produce large amount of complex parts in short time with high dimensional accuracy. In industrial aluminum casting factories, there are following problems to be solved:

- Low efficiency of the gas heating main furnace. Continuous energy consumption in the hold furnace to keep aluminum in molten condition.
- Conveyance of melted aluminum to hold furnace which leads accident risks such as falling-down and sudden drop off of vessel.
- Suppression of aluminum dross (aluminum oxide) which is produced around the surface of melted aluminum due to gradual reaction with air in the hold furnace. Aluminum dross degrades quality of die-casting production and it finally becomes waste.

If an aluminum melting device that can melt necessary amount of aluminum within a short time only when it becomes necessary (called just-in-time melting) can be developed, the melted aluminum material can be directly supplied to die-casting machines. The gas heating furnaces with low efficiency can be disused and the conveyance of melted aluminum also can be abolished. Therefore, in large scale aluminum die-casting factories, the just-in-time aluminum melting devices are required. To realize them, it is necessary to develop a high efficient and high speed aluminum melting technology. We have focused on the application of the induction heating using DC HTS coils to aluminum melting and have been investigating the possibility of aluminum melting. Fig. 1 shows the schematic illustration of our proposed induction heating device using HTS coils for aluminum melting. The aluminum materials are rotated in DC high magnetic field generated by HTS coils and the large eddy current joule heat induced in the aluminum material. In our former study [1], we have reported that 0.77 kg aluminum material can be melted by induction heating in DC magnetic field of 0.4-1.0 T. The results reported in [1] indicate that the induction heating with DC HTS coils can apply to aluminum melting. In this study to extend our former study [1], the 1/5 scale test device for aluminum melting by the induction heating using REBCO HTS coils are designed using the numerical electromagnetic and thermal analysis. In the paper, the design and fabrication process of the test device is reported.

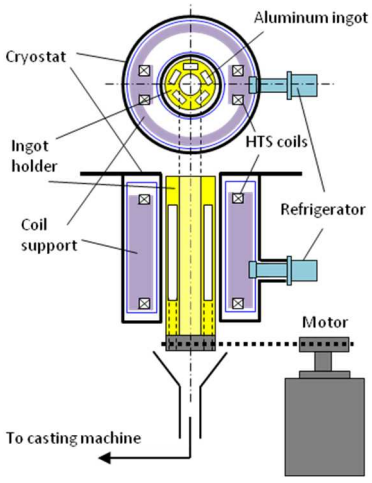


Fig. 1. Schematic illustration of proposed induction heating device for aluminum melting using DC HTS coils.

[1] T. Watanabe, S. Nagaya, N. Hirano, S. Fukui, "Elemental Development of Metal Melting by Electromagnetic Induction Heating Using Superconductor Coils", IEEE Trans. Appl. Supercond., Vol.26, Art. ID 3700504, 2016.

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