

MgB₂ THIN FILMS ON COPPER, TITANIUM, AND NIOBIUM BY PULSED LASER DEPOSITION IN KEK



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Abstract

We have been engaged in fabrication of high-T_c or MgB thin films on metallic substrates. At the international workshop thin films in Padova, we showed our basic idea to make an accelerating-mode cavity. In the first half of this paper, we report a subsequent development, mainly a partial success in fabricating superconducting film on a quadrant cavity of an accelerator structure. In the latter half, we describe some results concerning fabrication of films on Titanium and Niobium surfaces.

PRECURSOR POST-ANNEALING METHOD

After assembling the cavity with the component parts, we deposit MgB on the inner surface by pulsed laser deposition (PLD) and heat up to temperatures around 600 °C. This procedure is called precursor post-annealing method.
This method consists of two steps.

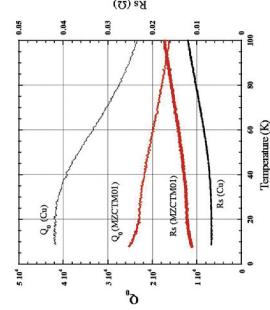
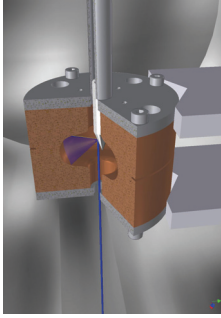
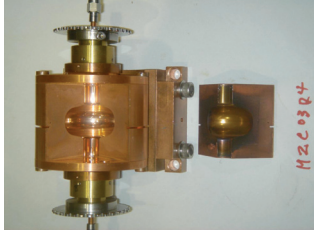
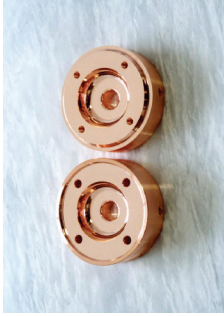
(i) The target is a pellet with a mixture of MgB₂ and Mg powder with the stoichiometry of Mg:B=2:1. Excimer laser with $\lambda=248$ nm (KrF), 400 mJ, and 5–10 Hz is irradiated on the target in 6×10^{-5} Torr Ar atmosphere at room temperature for 2 hr. The thickness of the fabricated film is around 1 μ m.

(ii) Typically, the precursors are heated in 1 atm Ar gas at 550–650°C for 10 min. This process must be optimized so that magnesium evaporation should be well controlled to become MgB₂ in the phase diagram .

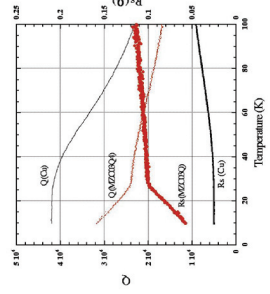
In the preceding experiments, we deposited chromium on the copper surface, then yttria-stabilized-zirconia (YSZ), and MgB₂ . However, we now know that if the copper oxide is completely removed from the surface, the chromium buffer layer can be omissible.

Two parts machined vertical to the axis are assembled to make a cavity. The inside surface is to be covered with MgB₂ films.

MEASUREMENT OF THE SURFACE RESISTANCE of TM010 Cu CAVITY

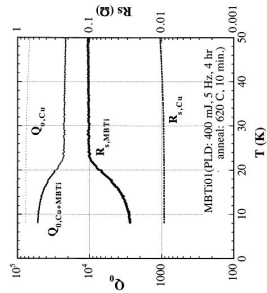
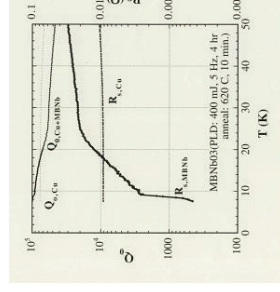
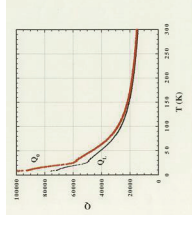
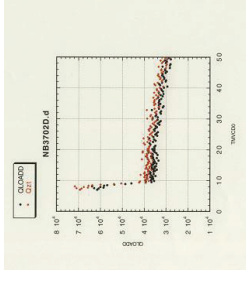
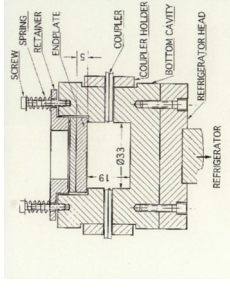


Q-value of the cavity fabricated with process (pi).



Microwave surface resistance of a quadrant.

RF Measurements of MgB₂ ON Nb and Ti



SUMMARY

We are making films by a precursor post-annealing method on copper cavities of an accelerator structure. Some of them have already showed superconducting properties. We concentrate our effort to find the better condition to get films of better quality. We hope we can make a highpower test in not-so-far future.
MgB₂ thin films on Nb disks show partial shielding effect which is important for high field cavity.