

# Improvement of temperature control during Nb 9-cell SRF cavity vertical electro-polishing (VEP) and progress of VEP quality



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Marui Galvanizing Co., Ltd. has been developing Nb 9-cell SRF cavity vertical electro-polishing (VEP) facility and technique for mass production in collaboration with KEK. Our first 9-cell cavity VEP facility was not enough to control temperature during VEP, so the polishing quality was not so high. In this article, we will report the progress of temperature distribution and polishing quality due to the improvement of temperature control system of electrolyte and cavity during VEP.

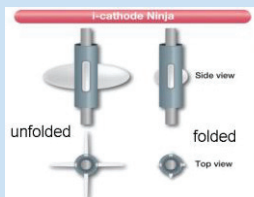
## Introduction



International linear collider (ILC) will require around 16000 niobium 9-cell cavities.

Mass production of cavities with higher efficiency and lower cost is desired.

Marui Galvanizing has been developing VEP technology in collaboration with KEK.  
• VEP facility construction and VEP experiment  
• Development of original cathode "Ninja"

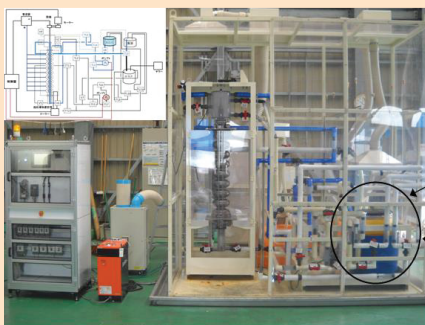


We constructed 9-cell cavity VEP facility and started VEP experiment.

The cavity temperature during VEP became around 50 °C and high quality EP couldn't be performed.

This time, we improved cavity temperature control system and performed VEP experiment.

## 1st try: 9-cell cavity VEP with heat exchanger for EP solution



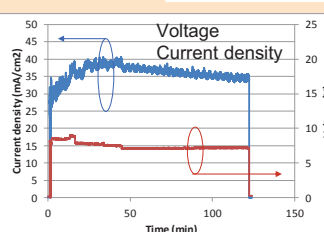
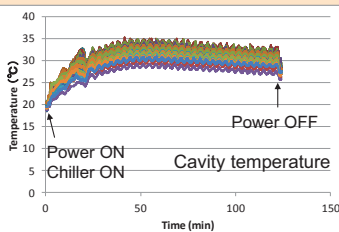
Heat exchanger



In EP solution tank

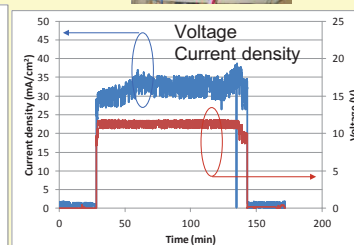
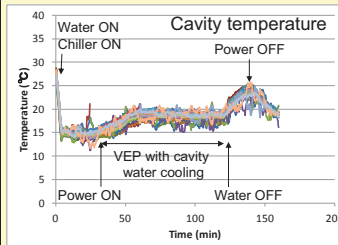
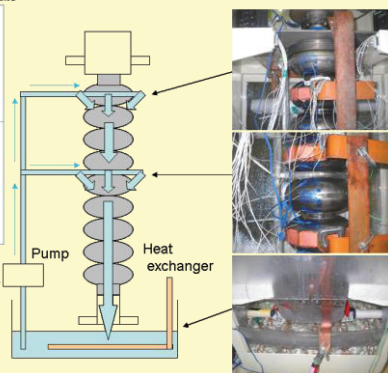
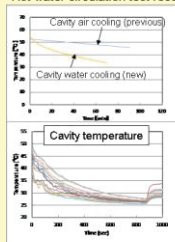


Bubble removal filter



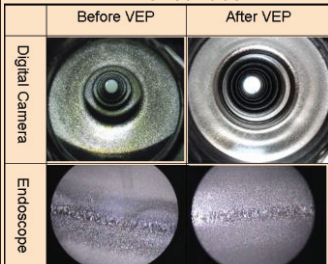
## 2nd try: VEP with heat exchanger and cavity water cooling system

Hot water circulation test results

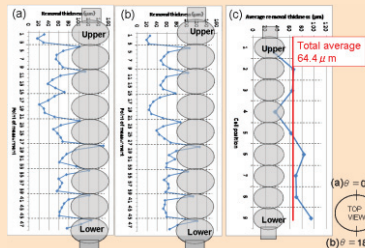


## Inner surface

Before VEP After VEP

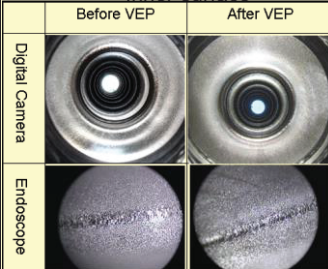


## Removal thickness

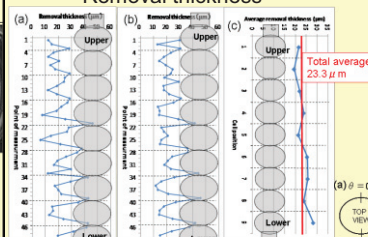


## Inner surface

Before VEP After VEP



## Removal thickness



- Cavity temperature during VEP was successfully kept under 35 °C.
- Inner surface after VEP was brighter than before.

- Cavity temperature during VEP was successfully kept under 30 °C.
- Inner surface after VEP was almost the same as before (bright).

## Summary

This time, we improved cavity temperature control system and performed VEP experiment.

- Cavity temperature during VEP was successfully kept under 30 °C.
- Brighter inner surface was achieved.

## Next step

- Ninja cathode improvement
- More parameter investigation
- Vertical test
- 9-cell coupon cavity

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