Precise evaluation of characteristics of the multilayer thin-film superconductor consisting of NbN and Insulator on pure Nb substrate

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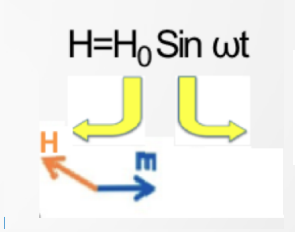
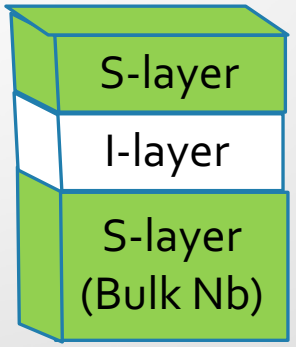
Introduction

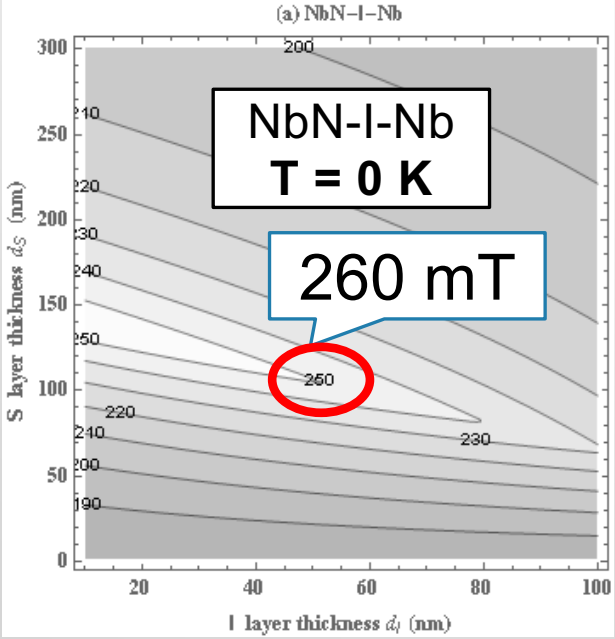
- The maximum accelerating gradient of superconducting cavity is limited by the magnetic field at which vortex avalanche occurs.
  - In this study, we calls such magnetic field as "**effective H_{c1}**", H_{c1}.
- Recently proposed theory predicts that H_{c1} is pushed up by Superconductor-Insulator-Superconductor structure (**S-I-S structure**).
- In order to verify this scheme, we are trying to make some experiments at Kyoto University.





Motivation of this study

- The proposed theory predicts a optimum set of the parameters to exhibit a good performances.
  - For example, NbN-Insulator-Nb sample is considered.
  - H_{c1} of this sample is shown in the following contour plot.
    - cf.) The effective Hc1 of pure bulk Nb is 180 mT.



- We evaluates Hc1 of S-I-S sample.
  - Top layer: NbN (200 nm)
  - Middle layer: SiO2 (30 nm)
- In order to determine Hc1, the third harmonic voltage method is used.
  - Please refer the poster presentation for details.

Effective Hc1 of S-I-S sample

- Generally, $H_{c1}(T)$ satisfies $H_{c1}(0)\times(1-(T/T_c)^2)$.