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Investigation of Nb3Sn Thin Films using Magnetic Field Penetration Measurements

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Nb3Sn is currently the most promising material other than niobium for future superconducting radiofrequency (SRF) cavities. To achieve high accelerating gradient, the behavior of Nb3Sn thin films in an external magnetic field should be studied. The magnetic field at first flux penetration is one of the key physical parameters to characterize them. Therefore, it is important to have a simple, efficient, and accurate technique to measure first flux penetration into a superconducting thin film directly. The conventional magnetometers are inconvenient for thin superconducting film measurements because these measurements are strongly influenced by orientation, edge, and shape effects. In order to measure the onset of field penetration in thin films and multi-layered superconductors, we have designed and built a system combining a small superconducting solenoid capable of generating a parallel surface magnetic field up 0.5 T and Hall probe to detect the first entry of vortices. This technique can be used to study Nb3Sn thin films along with qualitative and quantitative comparison of Nb3Sn with Nb for their SRF performances.

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