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Thickness dependence of superconducting properties in NbN thin films[1] MATTHEW BURTON, DOUGLAS BERINGER, MELISSA BEEBE, ELIZABETH VISOSKY, DAVID BRANTLEY, SHAAN SHARMA, KAIDA YANG, ALE LUKASZEW, College of William & Mary Department of Physics — Thin film NbN is a promising material currently researched for improvements in superconducting radio frequency (SRF) technology and applications. At present, bulk niobium SRF accelerating cavities suffer from a fundamental upper limit in maximally sustained accelerating gradients; however, a scheme involving multi-layered superstructures consisting of superconducting-insulating-superconducting (SIS) layers has been proposed to overcome this fundamental material limit of 50 MV/m [1]. The SIS multi-layer paradigm is reliant upon implementing a thin shielding material with a suitably high Hc1 which may prevent early field penetration in a bulk material layer and consequently delay the high field breakdown. It has been predicted that for thin superconducting films — thickness less than the London penetration depth (∼200 nm in the case of NbN) — the lower critical field Hc1 will be enhanced with decreasing thickness. Thus, NbN thin films with a high Hc1 value are prime candidates for such SIS structures. Here we present our study on the structure and superconducting properties of a series of epitaxial NbN thin films and correlate the effects of film thickness on the lower critical field, Hc1.

[1] A. Gurevich, Appl. Phys. Lett., 88, 012511 (2006).

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