Abstract Submitted
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Thickness dependence of superconducting properties in magnesium diboride thin films[1] DOUGLAS BERINGER, The College of William and Mary, CESAR CLAVERO, Lawrence Berkeley National Laboratory, TENG TAN, XIAOXING XI, Temple University, ROSA LUKASZEW, The College of William and Mary — Thin film MgB_2 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. 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 ($\sim$ 140 nm in the case of MgB_2) — the lower critical field Hc1 will be enhanced with decreasing thickness. Thus, MgB_2, with a high bulk Hc1 value is a prime candidate for such SIS structures. Here we present our study on the structure, surface morphology and superconducting properties on a series of MgB_2 thin films and correlate the effects of film thickness and surface morphology on Hc1.

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