High Quality YBCO on Perovskite Dielectric for Superconducting Microwave Resonators

Park, Joseph

I have synthesized the high temperature superconductor YBCO ($YBa_2Cu_3O_7$) on top of perovskite dielectric BCT ($Ba(Cd_{1/3}Ta_{2/3})O_3$) using pulsed laser ablation. Growth of this structure has not been reported in previous literature. The substrates were heated first to 635C at 200mTorr O_2, and BCT was deposited for twenty minutes with a Cd-enriched target. The substrates were then heated for thirty minutes to 760C and YBCO was deposited for thirty more minutes. After the deposition, the substrates were set to cool to 20C in ninety minutes with 400Torr of O_2. XRD (X-Ray Diffraction) and RBS (Rutherford Backscattering Spectroscopy) revealed the YBCO on BCT films were polycrystalline, with the thickness being 1800nm for the BCT and 2600nm for the YBCO. The substrate that produced the best properties of the YBCO/BCT was MgO with a Tc of 72.8K, followed by $LaAlO_3$ and $SrTiO_3$. All samples were found to be superconducting. Further research includes the exploration of microwave properties for the structure, along with varying growth conditions to make samples with superior microwave properties.

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