

Fabrication of Nb/Al₂O₃/Nb Josephson Junctions Using *in situ* Magnetron Sputtering and Atomic Layer Deposition

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Abstract - Atomic layer deposition (ALD) provides a promising approach for deposition of ultrathin low-defect-density tunnel barriers, and it has been implemented in a high-vacuum magnetron sputtering system for *in situ* deposition of ALD-Al₂O₃ tunnel barriers in superconductor-insulator-superconductor (SIS) Josephson junctions. A smooth ALD-Al₂O₃ barrier layer was grown on a Al-wetted Nb bottom electrode and was followed with a top Nb electrode growth using sputtering. The formation of tunnel barriers in these Nb/ALD-Al₂O₃/Nb trilayers was strongly indicated at room temperature by using the current-in-plane tunneling technique. Preliminary low temperature measurements of current-voltage characteristics (IVC) of the Josephson junctions made from these trilayers confirmed the integrity of the ALD-Al₂O₃ barrier layer. However, the $I_c R_N$ product of the junctions is much smaller than the value expected from the Ambegaokar-Baratoff formula suggesting a significant pair-breaking mechanism at the interfaces.

Keywords - Atomic layer deposition, Josephson junction.

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