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Atomic Layer Deposition Josephson Junctions for Cryogenic Circuit Applications

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Superconducting-insulating-superconducting (SIS) trilayers have been produced for Josephson Junction fabrication by thermal atomic layer deposition (ALD) processes. The trilayers are composed of alternating layers of $\text{Ti}_{0.4}\text{N}_{0.6}/\text{Al}_2\text{O}_3/\text{Ti}_{0.4}\text{N}_{0.6}$, deposited at 450°C , in a thermal ALD reactor on Al_2O_3 -coated silicon. The conformal nature of the ALD process provides excellent step coverage of superconducting and insulating films. The film thickness of a single ALD cycle being one mono-layer, allows us to precisely control the tunnel-barrier insulator thickness by counting the number of ALD cycles during the insulator deposition step. Tunnel-junctions with critical current 500 A/cm^2 are reported. Fabrication of Josephson Junctions and progress toward development of a single-element ALD Superconducting Quantum Interference Device (SQUID) will be discussed.

Less than 5 years of experience since completion of Ph.D

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Student (Ph.D., M.Sc. or B.Sc.)

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