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Growth of thin superconducting films and heterostructures by atomic layer deposition JEFFREY KLUG, THOMAS PROSLIER, NICHOLAS BECKER, JEFFREY ELAM, JAMES NOREM, Argonne National Laboratory, JOHN ZASADZINSKI, Illinois Institute of Technology, MICHAEL PELLIN, Argonne National Laboratory — We report the use of atomic layer deposition (ALD) to synthesize thin superconducting films and superconductor-insulator (S-I) heterostructures. ALD uses sequential self-saturating surface chemical reactions to produce uniform coatings with atomic scale control on substrates with arbitrary shape. The ALD process therefore offers the possibility of conformally coating complex shapes with precise, layered structures with tightly constrained morphology and chemical properties. Among other applications, such coatings may enable the production of superconducting radio frequency (SRF) structures with significantly better performance and yield than those obtained from bulk niobium. Furthermore, the atomic-scale thickness control afforded by ALD enables the study of superconductivity and associated phenomena in homogeneous layers in the ultra-thin film limit. In this respect, we will present results of ALD-grown $Nb_{1-x}Ti_xN$-based films and S-I heterostructures. Our program looks both at the metallurgy and superconducting properties of these coatings, and also their performance in working SRF structures.

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