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Fabrication of Circuit QED Quantum Processors, Part 2: Advanced Semiconductor Manufacturing Perspectives[1] D.J. MICHALAK, Intel, USA, A. BRUNO, QuTech and Kavli Institute of Nanoscience, TU Delft, The Netherlands, R. CAUDILLO, A.A. ELSHERBINI, J.A. FALCON, Y.S. NAM, Intel, USA, S. POLETTO, QuTech and Kavli Institute of Nanoscience, TU Delft, The Netherlands, J. ROBERTS, N.K. THOMAS, Z.R. YOSCOVITS, Intel, USA, L. DICARLO, QuTech and Kavli Institute of Nanoscience, TU Delft, The Netherlands, J.S. CLARKE, Intel, USA — Experimental quantum computing is rapidly approaching the integration of sufficient numbers of quantum bits for interesting applications, but many challenges still remain. These challenges include: realization of an extensible design for large array scale up, sufficient material process control, and discovery of integration schemes compatible with industrial 300 mm fabrication. We present recent developments in extensible circuits with vertical delivery. Toward the goal of developing a high-volume manufacturing process, we will present recent results on a new Josephson junction process that is compatible with current tooling. We will then present the improvements in NbTiN material uniformity that typical 300 mm fabrication tooling can provide. While initial results on few-qubit systems are encouraging, advanced processing control is expected to deliver the improvements in qubit uniformity, coherence time, and control required for larger systems.

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