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The Roles of Materials, Processing, and Design in Quantum Information Circuits¹

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Significant progress has been made in the coherence of superconducting circuits for resonators and qubits. Over the last decade, the importance of loss and decoherence from defects at interfaces and on surfaces has been recognized and mitigated by optimizing the materials and minimizing their participation in the circuit. This has resulted in novel new designs for quantum circuits, both 3D and 2D circuits. Some of our new designs will be discussed, and these developments will be compared and contrasted to ongoing surface science studies of ion traps that has resulted in improved operations with two orders of magnitude lower heating rates.

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