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Development of a Plasma-Enhanced Chemical Vapor Deposition System for High-Performance SRF Cavities and Thin Film Studies

Next-generation, thin-film surfaces employing Nb₃Sn, NbN, NbTiN, or other compound superconductors are essential for reaching enhanced RF performance levels in SRF cavities. However, optimized, advanced deposition processes are required to enable high-quality films of such materials on large and complex-shaped cavities. For this purpose, Cornell University developed and commissioned a plasma-enhanced chemical vapor deposition (CVD) system that facilitates coating on complicated geometries with a high deposition rate. This system is based on a high-temperature tube furnace with a high-vacuum, gas, and precursor delivery system, and uses plasma to significantly reduce the required processing temperature and promote precursor decomposition. Here we present the commissioned system with all the control aspects and safety considerations addressed and the materials we are interested in growing

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