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SRF characterization of multilayers

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Superconducting radio frequency (SRF) cavities with performance beyond the fundamental limits of bulk niobium require coating technologies. Multilayer systems with alternating thin films of superconducting and insulating material promise to boost the performance in terms of maximum accelerating gradient and surface resistance. Furthermore, the insulating layer prevents full penetration of vortices that would otherwise lead to an unmanageable level of RF dissipation. Using the Quadrupole Resonator (QPR) at Helmholtz-Zentrum Berlin, several series of multilayer samples have been characterized in a wide parameter space of temperature, RF field and frequency. Important aspects of the theoretical models could be verified experimentally, however, unexpected features such as a non-monotonic temperature dependence of the surface resistance and early quench limits have been observed. The measurements indicate that further parameters, especially concerning the insulating layer, have to be taken into account.

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