

High kinetic inductance superconducting amplifiers

Disordered superconductors exhibit a property called kinetic inductance, which effectively behaves as a non-linear inductance, making these material very interesting for the development of quantum circuits, especially for applications in the field of cQED, quantum sensing and quantum computing. Thin films offer the possibility to tune the inductance by optimising the chemical composition and the crystalline properties of the film, which depend on the deposition process. Tunable kinetic inductance values enable the exploration of a wide range of couplings between different elements in quantum circuits. Moreover, high-kinetic inductance resonators or artificial transmission lines can be exploited to achieve compact read-out devices and quantum circuits. At FBK, we have developed high-kinetic inductance thin NbTiN films for the microfabrication of low-noise and high dynamic range Kinetic Inductance Traveling Wave Parametric Amplifiers (KI-TWPAs). Besides the microfabrication of KI-TWPA devices, the optimised NbTiN films find direct applications for the development of a wide range of quantum circuits and technologies, such as high-kinetic inductance resonators, Kinetic Inductance Detectors (KIDs), superconducting nanowires and hybrid rf SQUID qubits.