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Effect of metamaterial engineering on the superconductive properties of ultrathin layers of NbTiN

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The electronic transport and optical properties of high quality multilayers of NbTiN/AlN with ultrathin NbTiN layers were characterized. The anisotropy of the dielectric function of the multilayers confirmed their hyperbolic metamaterial properties. The superconductive transition temperature, Tc, of these engineered superconductors was enhanced up to 32% compared to the Tc of a single ultrathin NbTiN layer while the resistivity per NbTiN layer remained unchanged. We have demonstrated that this Tc increase can be attributed to enhanced electron-electron interaction in superconducting hyperbolic metamaterials. The measured critical fields are high and have anomalous temperature dependence in the perpendicular to the magnetic field direction. These results demonstrate that the metamaterial engineering approach can be used to enhance Hc2.

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