

Ex situ elaborated proximity mesoscopic structures for ultrahigh vacuum scanning tunneling spectroscopy

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Abstract

We apply ultrahigh vacuum Scanning Tunneling Spectroscopy (STS) at ultra-low temperature to study proximity phenomena in metallic Cu in contact with superconducting Nb. In order to solve the problem of Cu-surface contamination, Cu(50nm)/Nb(100nm) structures are grown by respecting the inverted order of layers on SiO₂/Si substrate. Once transferred into vacuum, the samples are cleaved at the structure-substrate interface. As a result, a contamination-free Cu-surface is exposed in vacuum. It enables high-resolution STS of superconducting correlations induced by proximity from the underlying superconducting Nb layer. By applying magnetic field, we generate unusual proximity-induced superconducting vortices and map them with a high spatial and energy resolution. The suggested method opens a way to access local electronic properties of complex electronic mesoscopic devices by performing ex situ STS under ultrahigh vacuum. © 2014 AIP Publishing LLC.

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