Probing the local properties of superconducting silicon

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Heavily boron doped silicon epilayers prepared by gas immersion laser doping lead to a superconducting state at low temperature[1]. With a milliKelvin scanning tunneling microscope, we have performed density of states spectroscopy showing locally the conventional (BCS) nature of the superconductivity in silicon[2]. The observed variation on a nanometer scale of the superconducting energy gap value can be related to the distribution of boron atoms resolved by atom probe tomography. Since the latter technique gives an accurate three-dimensional spatial chemical composition of the superconducting silicon material, we also succeed to show that the boron atoms incorporated well above their solubility limit are still randomly distributed into the silicon lattice, without forming any cluster or precipitate[3].

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