PCP2-7

Local Density of States in Two-Dimensional Nano-Structured Superconducting Systems with Superconductor–Normal Metal Interfaces

*Saoto Fukui[1], Zhen Wang[1], Masaru Kato[2]

Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences[1]
Osaka Prefecture University[2]

Superconductor–normal metal (SN) interfaces occur important phenomena such as the Andreev reflection and a proximity effect. Also, superconductor–normal metal–superconductor (SNS) junctions are expected as many applications, for example, a SQUID, a single flux quantum logic, and so on. In recently developments, high-quality junctions with nano-structured superconducting films are made. In nano-structured systems, movements of electrons are restricted strongly and the quantum confinement effect occurs. Also, it is known that superconducting properties such as a critical temperature and a density of state oscillate as a function of a thickness of the superconducting film [1]. The other feature of the quantum confinement effect is a discreteness of energy levels. The quantum confinement effect in the superconductor is investigated actively, while in the case of superconductors with SN interfaces, effects of the quantum confinement effect on various properties are not investigated very much.

We investigate superconducting properties in nano-structured superconductors with SN interfaces, in particular, in the region of the quantum confinement effect. In this research, we focus on the discreteness of energy levels. The discreteness of energy levels affects a local density of state (LDOS), and the LDOS as a function of the energy has some peaks. Then, we investigate behaviors of the LDOS in nano-structured systems with the SN interface and SNS junctions theoretically. Experimentally, the LDOS can be measured through a differential conductance with the STM / STS measurement, so an electronic structure of a surface in the system is important. Then, we consider two-dimensional systems. In order to obtain the electronic structure in this system, we solve the Bogoliubov-de Gennes equations self-consistently with a two-dimensional finite element method [2]. Using solutions, we report dependences of sizes, shapes, potential barriers in SN interfaces, and widths of each metals on the LDOS.

[1] A. A. Shanenko, et al., Phys. Rev. B, **75**, 014519 (2007)

[2] H. Suematsu, et al., Physica C, **412-414**, 548 (2004)

Keywords: superconductor-normal metal interface, Bogoliubov de Gennes equations