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Observation of the current-phase relation of a characterized superconducting atomic point contact YOUITI OOTUKA, HISAO MIYAZAKI, AKINOBU KANDA, Univ. of Tsukuba, YAMAGUCHI TAKAHIDE, NIMS — The current-phase relation $I(\varphi)$ in a superconducting atomic point contact (APC) is different from that in a tunnel junction. Beenakker et al. treated this problem based on the idea of Andreev reflection, and obtained a formula for $I(\varphi)$ as a function of transmission coefficient τ of the contact. Measuring magnetic responses of a superconducting loop with an APC, Koops at al. determined $I(\varphi)$ to find a clear non-sinusoidal behavior. However, no characterization of the point contact was possible in their experiment. In this paper, we propose a new experiment in which we can determine both the transmission coefficients $\{\tau_i\}$ and $I(\varphi)$ relation: A device we should make is a dc-SQUID which consists of an APC and a tunnel junction. The coefficients $\{\tau_i\}$ can be determined by analyzing the sub-gap $I-V$ characteristics. On the other hand, $I(\varphi)$ of the point contact is derived from a dependence of the critical current on the magnetic flux, $I_C(\Phi)$. Using the EB-lithography and break junction technique, we performed the experiment at 90 mK. The $I-V$ characteristics can be fitted to the theory of multiple Andreev reflection quite well. The critical current is not symmetric to the magnetic field direction nor to the current direction, which means the $I(\varphi)$ is not sinusoidal.

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