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STATIONARY PROPERTIES OF JOSEPHSON SN-N-NS MICROBRIDGES

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Josephson weak links such as SN-N-NS microbridges have a good outlook for applications in cryoelectronic devices because of their potential high characteristics. However, in spite of relatively good theoretical understanding of main processes[1] in such structures an experimental situation is far from the optimum. For example, the $I_C R_N$ product (I_C is critical current, R_N is normal state resistance) of experimental bridges[2,3] is much more lower than theoretical predictions for this value which should be comparable with one in tunnel junctions. One possible reason of such depressed $I_C R_N$ is the proximity effect between superconducting film and normal (N) layer. It is obvious that $I_C R_N$ can be reduced by geometrical factors, for example, because of too small normal resistance. This fact requiers a relatively small thickness of N-layer d_N. Furthermore it seems possible to create large gradients ($I_C \backsim d_N^{-1}$) in vertical type microbridges by special current injection in order to raise up I_C (as in SNS sandwich) and keep high R_N ($R_N \backsim d_N^{-1}$ as in microbridge). On the other hand N-channel constriction due to small d_N reduces I_C to zero ($I_C \backsim d_N$). Therefore function $I_C(d_N)$ has to have a maximum. Thus the subject of the report is to investigate the influence of the proximity effect on properties of structures under consideration and to calculate function $I_C(d_N)$ with the aim of optimization.

Earlier, the influence of the proximity effect on properties of SN-N-NS microbridges has been analysed only phenomenologically[3]. In order to evaluate microscopic theory of Josephson effect in SN-N-NS microbridges we start from the following assumptions: 1) the condition of dirty limit is fulfilled for both S and N metals;

e; 3) the thick-
ength ξ_S^*, so that
close to that of
e of N layer equals

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on temperature,
$(\sigma_S \xi_N^{*2})$, where
and coherence
layer (in this
ations[4] have shown
n reduced by proxi
arison with Δ_0/e.
work of Usadel eq-

s normally to SN
dimensional. In
investigation of
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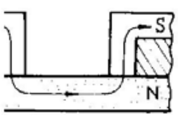
have reached at
lean N metal, k_B

(c)



s:(a) planar type;
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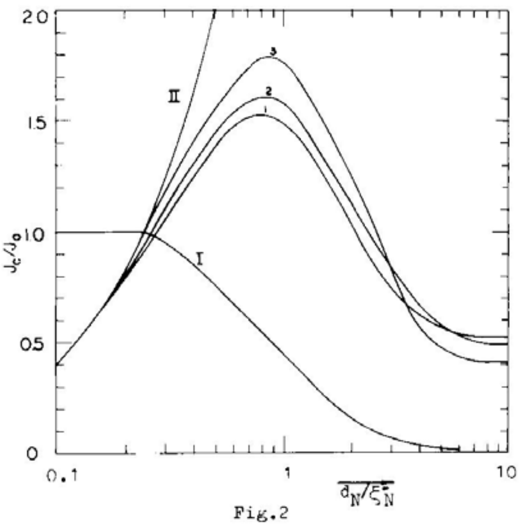

Fig.2

Critical current density J_C as a function of N-layer thickness d_N for various weak link lengths L/ξ_N^*: (1) - 4; (2) - 6; (3) - 8; I- $I_C R_N$ product vs d_N for $L/\xi_N^* = 8$; $I_C R_N$ is normalized to $V_0 = J_0 w R_N$, where $J_0 = \sigma_N \Delta_0 / e\pi T \cdot \exp(-L/\xi_N^*)$, w - the width of junction; II - asymptotical dependence $J_C(d_N)$ for quasi-onedimensional junction.

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