CORRECTION TO THE ARTICLE "CRITICAL CURRENT AND CRITICAL MAGNETIC FIELD IN HARD SUPERCONDUCTORS"

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V. V. SHMIDT

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In the paper referred to, we derived formula (10) for the critical current of a thin superconducting filament situated in an external magnetic field. This formula is valid in the case when H_0 and $H \ll H_c = 2\sqrt{2}\, H_{cm}\delta_0/r_0$, where H_c —critical transverse field of the thin filament [1].

To calculate a filamentary superconductor, it is more consistent and correct, however, to use in place of formula (10), the exact formula, which can be readily derived:

$$H_{I_c} = \frac{\sqrt{2}H_{cm}}{3\sqrt{3}}\frac{r_0}{\delta_0}\left(1 - \frac{H_0^2}{H_c^2} - \frac{H^2}{2H_c^2}\right)^{3/2}.$$

This formula is valid over the entire range of variation of H_0 and H. Carrying out all the calculations, in analogy with the article, we obtain the following final results.

1. The distribution of the critical current in the filamentary superconductor, in the absence of an external magnetic field, is of the form

$$j = j_{max}\left[1 + (ny/Ln_0)^2\right]^{-3/2},$$

where

$$j_{max} = \frac{c}{3\sqrt{6}} H_{cm} r_0^2 n/\delta_0^2, \quad n_0 = \frac{3\sqrt{3}}{\pi}\delta_0^2/(Lr_0^3),$$

and the dependence of the total critical current on the density of the filaments will be

$$J_c = \frac{c\sqrt{2}}{\pi} H_{cm}\frac{\delta_0}{r_0}\frac{n}{n_0}\left[1 + \left(\frac{n}{n_0}\right)^2\right]^{-1/2}.$$

2. The dependence of the critical current J_c on the external magnetic field H, parallel to the plane of the plate and perpendicular to the filaments, is conveniently represented in parametric form

$$H = (H_c/2)[f(n/n_0 + t) - f(n/n_0 - t)],$$
$$J_c = (cH_c/4\pi)[f(n/n_0 + t) + f(n/n_0 - t)],$$

where $f(x) = x(1 + x^2)^{-1/2}$, and the parameter t runs through all values from zero to infinity.

3. If the external field H is directed: a) along the filaments and b) perpendicular to the filaments in the plane of the plate, then the critical current will be

$$J_c = \frac{c}{2\pi} H_c (1 - h^2)^{3/2}\frac{n}{n_0}\left[1 + \frac{n^2}{n_0^2}(1 - h^2)^2\right]^{-1/2},$$

where $h = H/\sqrt{2}\,H_c$ for case a) and $h = H/H_c$ for case b).

It follows from these results that, accurate to within the order of magnitude, all the deductions made previously remain in force in the exact calculation. Thus, in particular, the total critical current of a filamentary superconductor tends to a certain limit $J_\infty = (c\sqrt{2}/\pi)H_{cm}\delta_0/r_0$ as $n \to \infty$, and reaches a value $0.9\,J_\infty$ for $n = 2n_0$.

[1] V. P. Silin, JETP 21, 1330 (1951).

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