Erratum: Field-dependent surface resistance for superconducting niobium accelerating cavities [Phys. Rev. Accel. Beams **14, 101002 (2011)]**

Wolfgang Weingarten

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The Erratum concerns the “Cooper limit” formula, Eq. (43), for the superconducting (sc) coupling constant $(NV)_{\text{eff}}$. This formula describes the boundary effect for the mixture of niobium and niobium monoxide in close proximity,

$$(NV)_{\text{eff}} = \frac{(NV)_N N_N v_N + (NV)_S N_S v_S}{N_N v_N + N_S v_S}. \quad (1)$$

Here $(NV)_S$ is the sc coupling constant of the “strong” (S) superconductor Nb, $(NV)_N$ is that of the “weak” (N) superconductor NbO, and v_S and v_N are the volume densities of the respective components S and N within the mixture. N_S and N_N are the “electron density of states” (DOS), in units of $\text{eV}^{-1} \text{m}^{-3}$. N_S and N_N were intentionally referred to as the “electron densities” of the respective superconductors in units of m^{-3} , so that they were claimed to be numerically identical to the DOS, but no justification was provided.

In the following, as a justification, $(NV)_{\text{eff}}$ is reevaluated using new data that appeared after publication of this paper [1,2]. Note that neither the absolute values of N_S and N_N nor those of the volume densities v_S and v_N are critical, but their relative values, N_N/N_S and v_N/v_S [cf. Eq. (1)], as published by one single author team, thereby increasing reliability. From $(NV)_{\text{eff}}$ follows the critical temperature T_{cNS} of the mixture Nb/NbO as a function of the relative composition $x = v_S/(v_S + v_N)$:

$$T_{\text{cNS}} = 1.14 \Theta_D e^{-1/(NV)_{\text{eff}}(x)},$$

shown in Fig. 1. Θ_D is the Debye temperature of the more abundant component of the mixture, NbO ($\Theta_D = 472$ K). The data used are summarized in Tables I and II.

FIG. 1. Critical temperature of the Nb/NbO composite in the Cooper limit of the proximity effect vs the volume fraction $x = v_S/(v_N + v_S)$ of the S component (Nb).

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TABLE I. Electron densities n of Nb and NbO.

	Nb	NbO	
A	92.9	108.9	g
ρ_m	8.57	7.3	g/cm^3
n	5.55×10^{22}	4.04×10^{22}	Nb-atoms/cm ³
$n = 0.6022 \times 10^{24} \times \rho_m / A$			
A: atomic weight, ρ_m : mass density			

TABLE II. Density of states (DOS) of Nb and NbO.

Nb (S)	NbO (N)	Unit	N_N/N_S
1.3 ^a	0.55 ^b	States/(Nb · eV)	
7.22×10^{22}	2.22×10^{22}	Nb-atoms/(eV · cm ³)	0.31
1.8 ^c	0.4	States/eV	0.22
5.56×10^{22d}	1.60×10^{22}	Electrons/(eV · cm ³)	0.29

^aReference [1].^bThis number concerns the Nb₃O₃ structure, not the hypothetical Nb₄O₄ structure.^cReference [2].^dThis paper.

It can be seen from Fig. 1 that the experimentally determined percolation temperature $T^* = 2$ K corresponds to a critical mixture x^* in the interval of 2.3% to 3.3%. This interval includes the critical mixture ($x^* = 3.01\%$) of this paper.

Since the publication of this paper, another paper dealing with percolation through voids around overlapping spheres appeared [3], as a supplement to Ref. [4]. Ref. [3] gives a wider interval for the critical mixing, about 2.5% to 4.5%, which agrees quite well with the above results. Therefore, these results are not contradictory.

Therefore, the modification of Eq. (43), as described above, has no significant effect on the value of $(NV)_{\text{eff}}$.

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