Low Frequency Electrical Noise Across Contacts Between a Normal Conductor and Superconducting Bulk $YBa_2Cu_3O_7$

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Virtually every practical device that makes use of the new ceramic superconductors will need normal conductor to superconductor contacts. The current-voltage and electrical noise characteristics of these contacts could become important design considerations. This paper presents I-V and low frequency electrical noise measurements on contacts between a normal conductor and superconducting polycrystalline $YBa_2Cu_3O_7$. The contacts were formed by first sputtering gold palladium pads onto the surface of the bulk superconductor and then using silver epoxy to attach a wire(s) to each pad. For small current densities, voltage across the contacts was found to be proportional to $I^{.71}$. The voltage spectral density, $S_V(f)$, a quanity often used to characterize electrical noise, very closely followed an empirical relationship given by,

$$S_V(f) = \frac{C(VR)^2}{f},$$

where V is the DC voltage across the contact, R is the contact resistance, f is frequency, and C is a constant found to be $2 \times 10^{-10}/\Omega^2$ at 78^o K. This relationship was found to be independent of contact area, contact geometry, sample fabrication technique, and sample density.