Low Frequency Electrical Noise Across Contacts Between a Normal Conductor and Superconducting Bulk YBa$_2$Cu$_3$O$_7$

J. Hall and T.M. Chen

Electrical Engineering Department, University of South Florida, Tampa, Florida 33620

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$_2$Cu$_3$O$_7$. 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 $I^2$. The voltage spectral density, $S_V(f)$, a quantity 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° K. This relationship was found to be independent of contact area, contact geometry, sample fabrication technique, and sample density.