NORMAL METAL - INSULATOR - SUPERCONDUCTOR JUNCTIONS WITH TITANIUM-GOLD AS NORMAL METAL LEAD

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Normal metal - insulator - superconductor (NIS) tunnel junctions are versatile and useful devices for thermometry, cooling, and metrological applications for the definition of ampere. Quite often, the normal metal lead needs to be highly conductive, so copper has been a common choice. However, Cu has its problems when the junctions have to go through additional fabrications steps, such as second layer of lithography, plasma etching etc. We have observed how the Cu electrode degrades strongly with heating, and in contact with some solvents. Thus, it is desirable to find other alternatives for the normal metal.

We have successfully fabricated superconductor - insulator - normal metal - insulator - superconductor (SINIS) junctions in which Al acts as superconductor, AlO_X is the insulator, and the normal metal consists of a thin Ti layer (5 nm) covered with a much thicker Au layer (40 nm). Although Ti is a superconductor, the direct contact with the Au layer causes the whole bilayer to be in the normal state, due to the inverse proximity effect. We characterized the junctions by measuring their current-voltage curves and current biased temperature response (thermometry) at temperatures between 60 mK and 750 mK, and found near ideal response. The tunneling resistance of these junctions was typically around $2.3\ \mathrm{k}\Omega$ immediately after lift-off, and the resistance decreased by 13 % when the junctions were in cleanroom during 6 weeks. This behavior is in contrast with junctions made of other materials, which typically have an order of magnitude higher tunneling resistance with the same oxidation parameters, and a trend of increasing tunneling resistance with age.