

Cryoconnect Reaching to the cold...

Choosing wire types in applications:

There are a many resistance wire alloys and a few superconducting wires available for your *Cryoconnect* looms plus pure metals.

We use a variety of wires for temperatures from 300K to mK.

From Room Temperature to a lower temperature stage:

Resistance alloys are the general choice here. The alloys decrease thermal conductivity at the expense of increased electrical resistance and the choice is often down to availability of wire with the preferred insulation material. The design proceeds with balancing the thermal budget and the number of wires and the voltage drop across down the wire to determine the wire diameter and lengths (minimum lengths are determined by the cryostat geometry). With high impedance sources the voltage drop is usually negligible. Manganin and constantan being commonly used.

It is sometimes necessary to measure the current through a device or circuit and voltage drops across a resistance wire may be a nuisance requiring additional room temperature circuitry and limiting the current available for measurement. In these cases it may be possible to minimize resistance by using resistance wire for part of the loom and change to a superconducting alloy at a lower temperature. This is often achieved with NbTi wire to avoid the complexity of changing wires at some intermediate point. NbTi wire will go superconducting below about 9K.

At the lowest temperatures

At the lowest temperatures minimizing the heat leak due to wiring is very important and superconducting wires are often used. These are at temperatures well below T_c and provide the best thermal isolation in the region of 400mK to a few mK. Typically NbTi is used.

High magnetic fields

In high magnetic fields superconductivity is suppressed and most wires exhibit some level of magneto resistance. It is generally useful to minimize this affect. Wires that have low magneto resistance include phosphor bronze and NiCu alloys.

Different materials at different temperatures

It may be necessary to have a resistance wire to minimize the heat leak to a system, but at constant temperature stages wires with low resistance may be used to minimize resistance, especially where considerable lengths of wire is needed. Typically copper, aluminum or silver may be used.

