

OVERVIEW

The following is a comparison of solid copper (Cu) wire with copper clad aluminum (CCA) wire for use as the center conductor in cable television trunk and feeder semiflexible coaxial cable with an aluminum outer conductor.

| Property | Soft Bare Copper | Copper Clad Aluminum |
|--|------------------|----------------------|
| Tensile Strength | 36 kpsi | 17 kpsi |
| Elongation @ Break | 35% | 20% |
| Break Strength (0.500 inch cable) | 336 pounds | 160 pounds |
| Elastic Modulus | 16 M psi | 10.6 M psi |
| Density | 8.9 g/cc | 3.32 g/cc |
| Weight per 1000 feet (0.500 inch cable) | 36.0 pounds | 13.4 pounds |
| Copper Thickness (0.500 inch cable) | Radius | 2.8 mils |
| Resistivity (microhm-cm) | 1.72 | 2.83 |
| Resistance per 1000 feet (0.750 inch cable) | 0.381 ohms | 0.606 ohms |
| Loop Resistance per 1000 feet (0.750 inch cable) | 0.547 ohms | 0.772 ohms |
| Relative Cost per pound | 1.00 | 1.76 |
| Relative Cost per foot (0.500 inch cable) | 36.00 | 23.64 |

PHYSICAL PROPERTIES

The following table lists the pertinent properties of both types of wire. The CCA wire is composed of a thin layer of copper over an aluminum core, the copper comprising nominally 10 percent of the wire's volume.

Comparisons between the two materials are made for four categories: mechanical, electrical, economical, and installation.

Mechanical

Copper wire is stronger, more durable, but heavier than CCA wire. Present connector designs do not permit full advantage to be taken of copper's greater strength. However, none of the cable's components, including the center conductor, is designed to be load bearing. The greater weight of copper is a slight disadvantage.

CCA's reduced elastic modulus reduces cable stiffness.

Electrical

Copper has a lower DC resistance than CCA. This characteristic is important when determining power requirements and power supply locations. At 6 Amps, 0.750 inch cable with a copper conductor has a voltage drop of about 3.3V per 1000 feet, while the same cable with a CCA conductor has a 4.6 volt drop. There may be cases where

an additional amplifier can be fed from the same power supply with Cu wire and not with CCA wire.

Above 5 MHz, there is no significant difference in attenuation between the two types. As the frequency increases, the current concentrates in thinner and thinner layers at the surface of the conductor, thus reducing the effective cross-sectional area and giving rise to an AC resistance. The equivalent AC resistance of the conductor can be represented by a tube having the same OD with a thickness of one skin depth which at 5 MHz is about 1.2 mils in copper. Because the copper thickness on the 0.500 inch cable is more than twice this thickness, the CCA conductor functions the same as if it were solid copper.

Experience has shown that the processing properties of CCA improved SRL performance in the finished cable. The reason is that solid copper is more difficult to process without causing mechanically induced periodic impedance variations (SRL).

OTHER FACTORS

Economical

Pound for pound Cu wire is cheaper than CCA. However, because copper is more than twice as dense as CCA, it costs more than 50 percent more per foot.

The reduced weight of CCA provides lighter cables reducing shipping costs, stress on reels, stress on strand wires and reduced frictional force in conduit pulls.

In view of the historical volatility in copper pricing, the reduced copper content in CCA results in smaller cost variations.

Installation

Probably the most critical difference between the two types of wire is the ability of a splicer to reliably install a connector on the cable. A reliable connection can be made on either cable, but the splicer must exercise caution when he removes the dielectric. Usually a knife is used to remove the bulk of the dielectric. The conductor must then be scraped clean either with a fingernail or plastic block, taking care not to nick the surface of the wire. After a proper connection has been made, the two materials perform equally well.

SUMMARY

Copper wire has a number of advantages over CCA wire. In most cases the advantages are not very significant. With solid copper, however, a splicer may tend to be more careless when removing the dielectric than from a CCA conductor.

The most important advantages of CCA over copper are that it is about 34 percent cheaper and 63 percent lighter. At frequencies above 5 MHz, the electrical performance of the two materials is equal. Cables produced with CCA typically exhibit improved SRL performance.