MEDICAL TECHNOLOGIES DIVISION

The Advantages of Stainless Steel versus Silver-Clad Copper Wire for use as Medical Extrusion Core Wire

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Abstract
Silver-clad copper (Sil-Cop) wire is often selected for use as medical extrusion core wire due to its biocompatibility and elongation characteristics. However, it has been observed that the silver cladding may flake when used in this type of application, leaving residue in equipment and finished catheters. An alternative material, such as 300 series stainless steel, has comparable performance and compatibility. As a single alloy wire, it eliminates the risk of flaking.

Introduction
The performance of stainless steel extrusion core wire was tested against Sil-Cop to compare overall diameter profile, percent diameter reduction, and force requirements. Various sizes of each wire type were put under an axial load and elongated. Once elongated, the diameter of the wire was measured at points along the length of the sample. The force required to elongate and reduce the diameter of the samples was also measured and compared.

Experimental Results
Test 1: Diameter Reduction
This test determined the overall diameter reduction profile of 300 series stainless steel and Sil-Cop. Samples of both materials were elongated under an axial load and the diameter was measured to determine which deformed more consistently. Diameter measurements were taken at intervals (every six inches) along each wire and recorded. For comparison, a sample of each wire type is presented in *Table 1: Diameter Profile Comparison.*

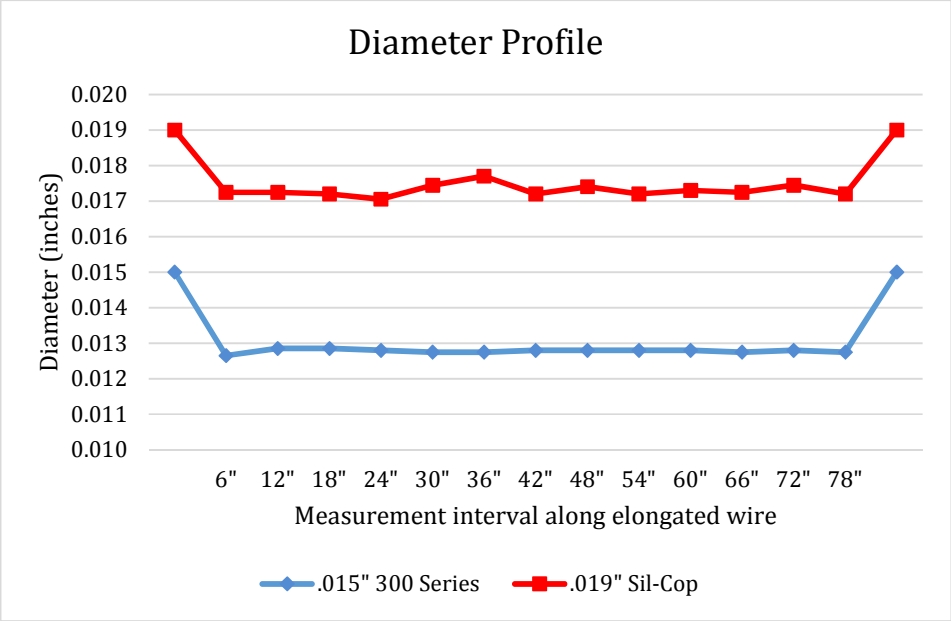

Table 1: Diameter Profile Comparison

We tested 0.015” 300 series stainless steel wire and observed the following:
- At 6”, the wire diameter measured 0.01265”
- At 12”, the wire diameter measured 0.01285”
- At 18”, the wire diameter measured 0.01285”
- At 24”, the wire diameter measured 0.01280”
- At 30”, the wire diameter measured 0.01275”

- At 36”, the wire diameter measured 0.01275”
- At 42”, the wire diameter measured 0.01280”
- At 48”, the wire diameter measured 0.01280”
- At 54”, the wire diameter measured 0.01280”
- At 60”, the wire diameter measured 0.01280”
- At 66”, the wire diameter measured 0.01275”
- At 72”, the wire diameter measured 0.01280”
- At 78”, the wire diameter measured 0.01275”

We tested 0.019” Sil-Cop wire and observed the following:

- At 6”, the wire diameter measured 0.01725”
- At 12”, the wire diameter measured 0.01725”
- At 18”, the wire diameter measured 0.01720”
- At 24”, the wire diameter measured 0.01705”
- At 30”, the wire diameter measured 0.01745”
- At 36”, the wire diameter measured 0.01770”
- At 42”, the wire diameter measured 0.01720”
- At 48”, the wire diameter measured 0.01740”
- At 54”, the wire diameter measured 0.01720”
- At 60”, the wire diameter measured 0.01730”
- At 66”, the wire diameter measured 0.01725”
- At 72”, the wire diameter measured 0.01745”
- At 78”, the wire diameter measured 0.01720”

Test 2: Force Requirements & Average Percent Reduction in Diameter

This test determined the force required (in Newtons) to elongate 300 series stainless steel and Sil-Cop. The force was measured as samples of each type of wire were elongated under an axial load. Naturally, the diameter decreases as elongation increases. The average percent reduction in diameter was calculated at this time and correlated with the force measurements.

300 series stainless steel was tested to observe the rate at which it deformed under axial load. The results are depicted in *Table 2: 300 Series Force Requirements and Average Percent Diameter Reduction.*

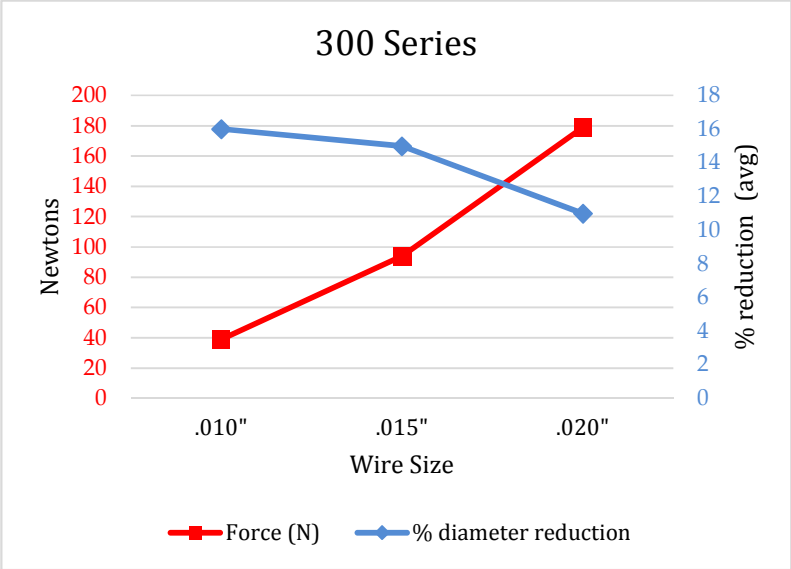

Table 2: 300 Series Force Requirements and Average Percent Diameter Reduction

- .010” 304 wire experienced a 16% reduction in diameter under 39 Newtons of force
- .015” 304 wire experienced a 15% reduction in diameter under 94 Newtons of force
- .020” 304 wire experience an 11% reduction in diameter under 179 Newtons of force

Sil-Cop wire was tested to compare its diameter reduction profile to that of the 300 series stainless steel. It was observed that Sil-Cop deformed at the following rate as depicted in *Table 3: Sil-Cop Force Requirements and Average Percent Diameter Reduction* below.

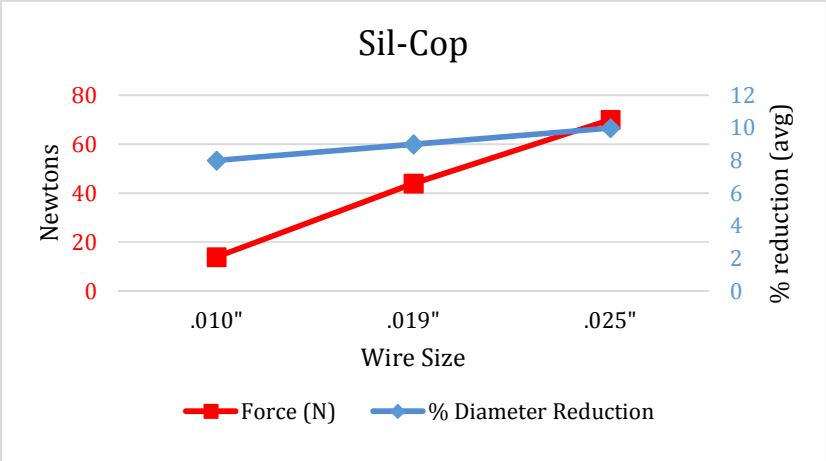

Table 3: Sil-Cop Force Requirements and Average Percent Diameter Reduction

- .010” Sil-Cop wire experienced an 8% reduction in diameter under 14 Newtons of force
- .019” Sil-Cop wire experienced a 9% reduction in diameter under 44 Newtons of force
- .025” Sil-Cop wire experienced a 10% reduction in diameter under 70 Newtons of force

Conclusion

Upon conclusion of testing it was determined that 300 series stainless steel is a very suitable replacement for Sil-Cop wire to eliminate the potential for flaking when used in medical extrusion core wire applications. Both materials were proven to have very similar overall performance characteristics. It was concluded that although stainless steel requires more force to elongate, the diameter profile as compared to Sil-Cop was much more uniform under similar force. In addition, it was discovered that when a certain amount of force was applied to both stainless steel and Sil-Cop wire, stainless steel had a higher yield.

For Questions or comments related to this report, contact:

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