WIRE

Medical products

Sandvik Bioline® Coated wire

SANDVIK

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Polymer coatings and metallic electroplating can be applied to many medical grades, such as F562, 304V, 316LV, and other alloys depending on the medical application. Coating the wire prior to incorporating it into a device provides more complete coverage over the entire surface area of the wire, rather than strictly on the outside of a device. The polymer coatings can provide a dielectric barrier when the wire in the device is used to transmit electrical signals or provide electrical current for medical therapies. Polymer coatings can also be used for ionic barriers, enhanced corrosion resistance, providing a lubricious surface and/or be used for lead identification. Electroplated coatings can be used to enhance the joinability of the base wire grades (i.e. solderability, weldability, ultrasonic bonding etc), increase the conductivity and/or provide a more noble surface.

PTFE is a generic equivalent of Teflon® (registered trade mark of Du Pont Corporation) and is used as a coating on fine wire for either dielectric protection or to enhance lubricity. Aqueous based PTFE is typically applied to precious metal alloys such as PtIr of less than 0.100 mm and is clear in color. Solvent based PTFE is applied to the wires in the 0.1 mm to 0.8 mm range for applications such as catheter guide wires. The solvent based PTFE grades provide a balance between good adhesion and good lubricity in these applications. They are supplied in various colors such as green, blue, grey and clear.

Electroplating and polymer coating can be performed on square and ribbon wires in addition to round wires. Sandvik's speciality is gold plated copper (0.02 mm and larger) but plating on a wide variety of other metals is possible (i.e. nickel, nickel chrome, silver and copper alloys). Nickel plating and/or a nickel interlayer is also possible.

Polymer coated wires can be combined in multifilar configurations such as bifilar, trifilar, quadfilar etc. Multifilar wires simplify wire handling when multiple signals are required for a device. Multifilar wire cables can be provided in a flat or bundled configuration and eight different colors and multiple shades of these colors are available for easy identification. Common uses of multifilar coated wires are bifilar pairs for medical micro-thermocouple applications and quadfilar gold-plated copper leads for sensor signal transmission.

PRODUCTION PROCESS

Polymer coating

The coating method used is called "flood coating". This method allows tight dimensional controls and ultrathin wall thicknesses. An older process for Teflon coating, still in major use today, is "electrostatic spray coating" which is applied to a finished medical device. The flood process offers some advantages over the electrostatic process, including improved adhesion of PTFE to the wire, cosmetic enhancements and control of the coating thickness.

The standard dielectric polymer coatings can be manufactured in accordance with the National Electrical Manufacturers Association (NEMA) standards listed below or be modified to meet customer specific requirements (i.e. ultrathin build, not listed in NEMA).

	Solvent based	Water based
Coating	Polyamid; Polyester; Polyesterimide; Polyethersulfone; Polyphenylsulfone; Polyimide; FEP; Polyurethane; Polyvinylacetyl	PTFE
Procedure	Flood coating	Single pass flood coating process thickness max: 0.00635mm (0.00025 inch) (multitimes)

Metal electroplating

Coating: Au, Ag, Cu, Ni

Procedure:

The electroplating method is reel-to-reel in order to provide continuous lengths of coated wire. The plated surface can be provided in an as plated condition or can be further processed (drawn, annealed) to the finish size after plating. Other electrochemical techniques (anodizing, electropolishing, electrocleaning) are also available to provide surface modifications to metal wire surfaces. Anodizing is used to chemically oxidize aluminum alloys for improved dielectric strength.

Note: Electrical testing that can be performed on these materials includes: dielectric breakdown tests in air or saline solution, continuity tests and pin hole testing.

APPLICATIONS

The primary use for polymer coated, precision medical wire is in sensor applications in vivo diagnostic and in therapeutic procedures, where electrical signals or currents are conducted micro-invasively. Key product features of the Sandvik Bioline range include small diameter (approx. 0.025 mm) variety of polymer coatings, offered either as standard or as custom-coated to precise requirements and specifications. The extremely thin coatings, applied in a uniform and pinhole-free way, guarantee excellent electric isolation properties. Typical end use applications include heart mapping devices, blood pressure and temperature measuring equipment, tissue temperature sensors and brain sensors.

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While many of these applications did not exist five to ten years ago, developments in coating technology, coupled with the cooperation between device manufacturers and material suppliers, has resulted in improved product performance, reduced trauma and new product features, allowing medical procedures that were not previously possible.

INSULATING COATING

Kanthal PC designation	Description	Thermal class (°C)	NEMA MW 1000 spec.	General comments
FORMVAR	Polyvinyl Acetal insulation	105	MW15-A,C	Excellent flexibility, abrasion resistance and chemical stability
4025 POLYURETHANE	Polyurethane insulation	130	MW75-C	Long term cure stability. Easily solderable
POLY	Polyurethane insulation	155	MW2-C MW75-C MW79-C	Excellent dielectric properties and easily solderable
POLY/NYLON	Polyurethane with polyamide topcoat	155	MW28-C MW80-C	Easily solderable; abrasion resistant & easier winding
POLY180B	Polyurethane insulation	180	MW79-C	Highest temperature Polyurethane - easily solderable
TRI-2-SOD	Solderable polyester-imide insulation	180	MW26-C MW77-C	High temperature capability solderable insulation
TRI-2-SOD/NYLON	Solderable polyester-imide with polyamide topcoat	155	MW27-C	Solderable Polyester with the toughness/windability of Nylon
POLYCLAD	THEIC modified polyester insulation	200 for copper 220 for aluminum	MW72; MW74	Temperature stability of Polyester
POLYCLAD/NYLON	THEIC modified polyester with polyamide topcoat	180	MW76	Temperature stability of Polyester with the toughness/windability of Nylon
POLYCLAD/AMINID	THEIC modified polyester with polyamide-imide topcoat	200 for copper 220 for aluminum	MW35; MW73	Increased temperature capability over POLYCLAD N.
ESTMIDE	Polyester-imide insulation	180	MW30	Good temperature stability, solvent resistance & windability
AMINIDE	Polyamide-imide insulation (also usable as topcoat)	220	MW81-C	High temperature insulation with lubricity & chemical resistance
PAC 240	Aromatic polyimide insulation	240	MW16; MW20; MW71	Highest temperature capability with good chemical resistance. Mechanically strip before soldering
TEFLON R	Polytetrafluoroethylene insulation	260	None	Excellent thermal, dielectric and chemical resistance

TYPICAL SPECIFICATIONS FOR GOLD PLATED COPPER WIRE (standard thickness Polyurethane insulation)

	44 AWG	46 AWG	47 AWG	48 AWG	50 AWG	51 AWG	52 AWG
Bare wire diameter (mm)	0.048 +/-0.002	0.040 +/-0.002	0.036 +/-0.002	0.031 +/-0.001	0.025 +/-0.001	0.022 +/-0.001	0.020 +/-0.001
Bare wire diameter (inches)	0.00190 +/-0.0001	0.00157 +/-0.0001	0.00140 +/-0.0001	0.00124 +/-0.00006	0.00099 +/-0.00005	0.00088 +/-0.00005	0.00078 +/-0.00005
Gold plating thickness (µm)	1.78+/-0.51	1.78+/-0.51	1.78+/-0.51	1.78+/-0.51	1.14+/-0.51	1.14+/-0.51	1.14+/-0.51
Gold plating thickness (µinch)	70 +/- 20	70 +/- 20	70 +/- 20	70 +/- 20	45 +/- 20	45 +/- 20	45 +/- 20
Insulation wall thickness (mm)	0.0053 +/-0.0015	0.0048 +/-0.0015	0.0044 +/-0.0016	0.0039 +/-0.0015	0.0030 +/-0.0012	0.0028 +/-0.0012	0.0025 +/-0.012
Insulation wall thickness (inches)	0.000210 +/-0.00006	0.000190 +/-0.00006	0.000175 +/-0.000065	0.000155 +/-0.00006	0.000120 +/-0.00005	0.000110 +/-0.00005	0.000100 +/-0.00005
Min. break load (g)	44	30	25	20	12	9	7
Min. elongation (%)	16	14	13	12	7	7	7
Resistance min/max (Ω/m)	8.8/10.8	12.9/16.3	16.4/20.5	22.6/26.1	33.0/41.0	41.8/53.4	52.9/67.9
Min. dielectric strength (V/µinch)	1500	1500	1500	1500	1500	1200	1200
Electrical continuity (breaks/100 feet@20V)	0	0	0	0	0	0	0
Reference weight (g/cm)	0.1855	0.1307	0.1060	0.0849	0.0521	0.0420	0.0338

FURTHER INFORMATION

Material datasheets and in-depth technical information about Sandvik Bioline grades and products are available on the Sandvik website, www.sandvik.com/medical

Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice.

This datasheet is only valid for Sandvik material. Other material, covering the same international specifications, does not necessarily comply with the mechanical and corrosion properties presented in this datasheet.

Sandvik Materials Technology

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