



# METKON

## Application Note

### Metallographic Preparation of Copper wire with an enamel coating



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Magnet wire or enameled wire is a copper or aluminium wire coated with a very thin layer of insulation.

It is used in the construction of transformers, inductors, motors, speakers, harddisk head actuators, electromagnets, and other applications that require tight coils of insulated wire.



The wire itself is most often fully annealed, electrolytically refined copper. Aluminium magnet wire is sometimes used for large transformers and motors. Contrary to its name, the insulator is hardly ever enamel.

Smaller diameter magnet wire usually has a round cross section. This kind of wire is used for things such as electric guitar pickups. Thicker magnet wire is often square, rectangular or hexagonal (with rounded corners) in cross section, packing more efficiently and having greater structural stability and thermal conductivity across adjacent turns.

The samples for this application:



## Application Requirements



	Order Code	Description
Equipment Used	16 04	MICRACUT 151
Clamping Device	GR 0401	Universal Specimen vise
Cooling Fluid	19 905	METCOOL II Cooling Fluid, 1 lt.
Cutting Disc	18-150	TRENO HP Ø150 mm

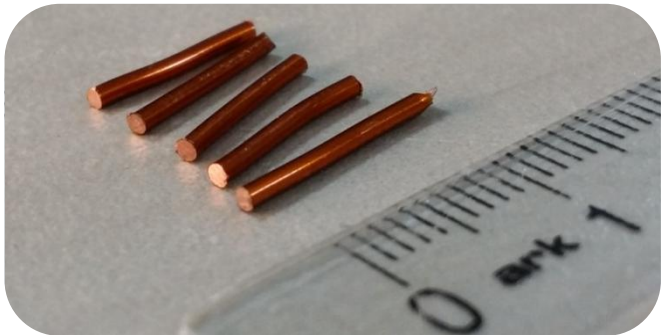
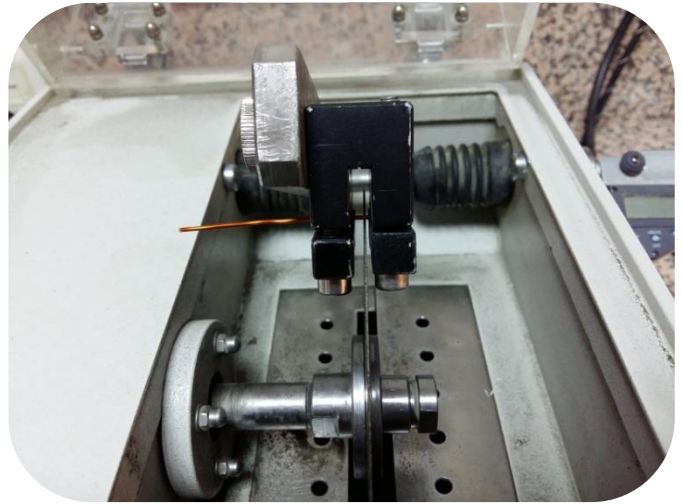
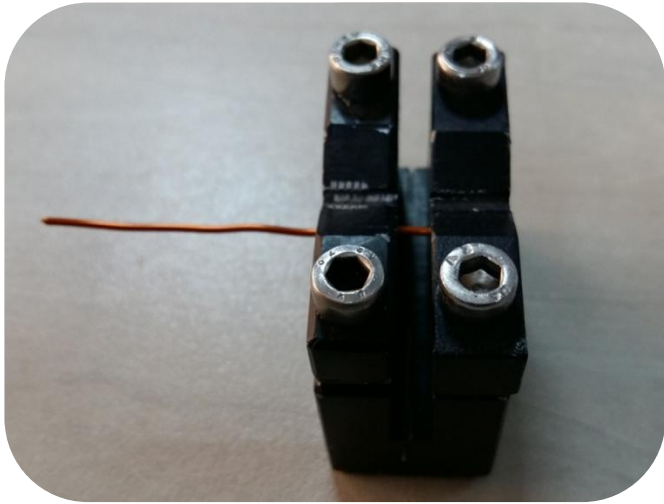
	Order Code	Description
Hardener	29 511	DMT 20 Powder
Resin	29 512	DMT 20 Fluid
Accessories	29-555	Embedding form Ø40 mm
	29-601	Stainless steel clips



	Order Code	Description
Equipment Used	36 09-250 / 30 09	FORCIPOL 2V / FORCIMAT
Accessories	31 22	Aluminum Disc, 250 mm
	31 63	Splash Guard, 250 mm
	39-003-250	Ø 250 mm, Special Magnetic Foil
	39-093-250	Ø 250 mm, Thin Metal Plate(5 pcs)
Sample Holder	33 01	Sample holder, 6 x Ø40 mm

## Sample Preparation Processes

With the help of the GR 401 sample cut into pieces.

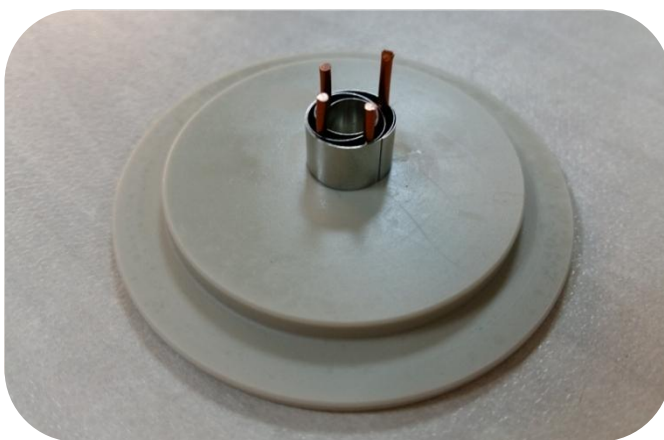


Cutting Parameters are:

**RPM:** 950 r/min.

**Total cutting time of all pieces:** 5 min.

Cutted pieces were mounted with cold mounting method.



Cold Mounting Parameters are:

**Resin:** 2 parts.

**Hardener:** 1 part.

**Mixing time:** 20 sec.

**Preparation of mixture and curing time:** 10 min.

After molding operation samples prepared with FORCIPOL 2V & FORCIMAT Grinding and polishing system.

Grinding and polishing steps can be seen below:

	Surface	Abrasive	Lubricant	Force per Sample, (N)	Time (min.)	Disc speed (rpm) Rotation	Head Speed (rpm) Rotation
Grinding Step 1	DEMPAX [38-040-240]	240 grit SiC	Water	15 N	1 min.	250 CW	100 CW
Final Grinding	DEMPAX [38-040-2500]	2500 grit SiC	Water	20 N	2 min.	250 CW	100 CW
Polishing Step 1	METAPO-B [39-033-250]	DIAPAT-M 3 $\mu$ [39-420-M]	DIAPAT [39-502]	20 N	3 min.	150 CW	75 CCW
Final polishing	FEDO-1 [39-065-250]	DIAPAT-M 1 $\mu$ [39-410-M]	DIAPAT [39-502]	10 N	2 min.	150 CW	50 CCW

**Result**

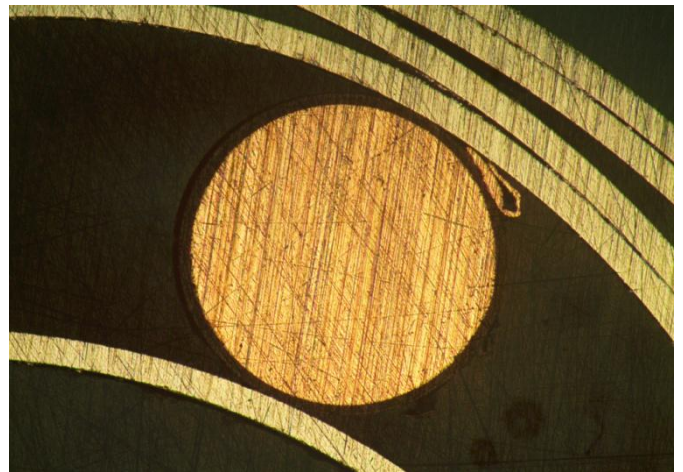
After the 2500 grit SiC paper:

NO 1:



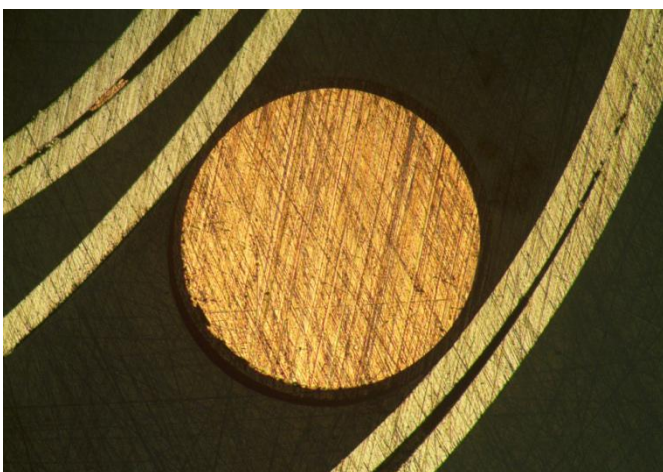
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NO 2:



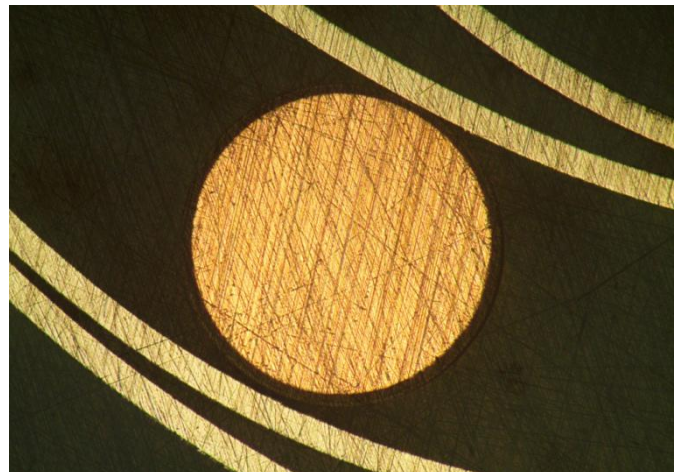
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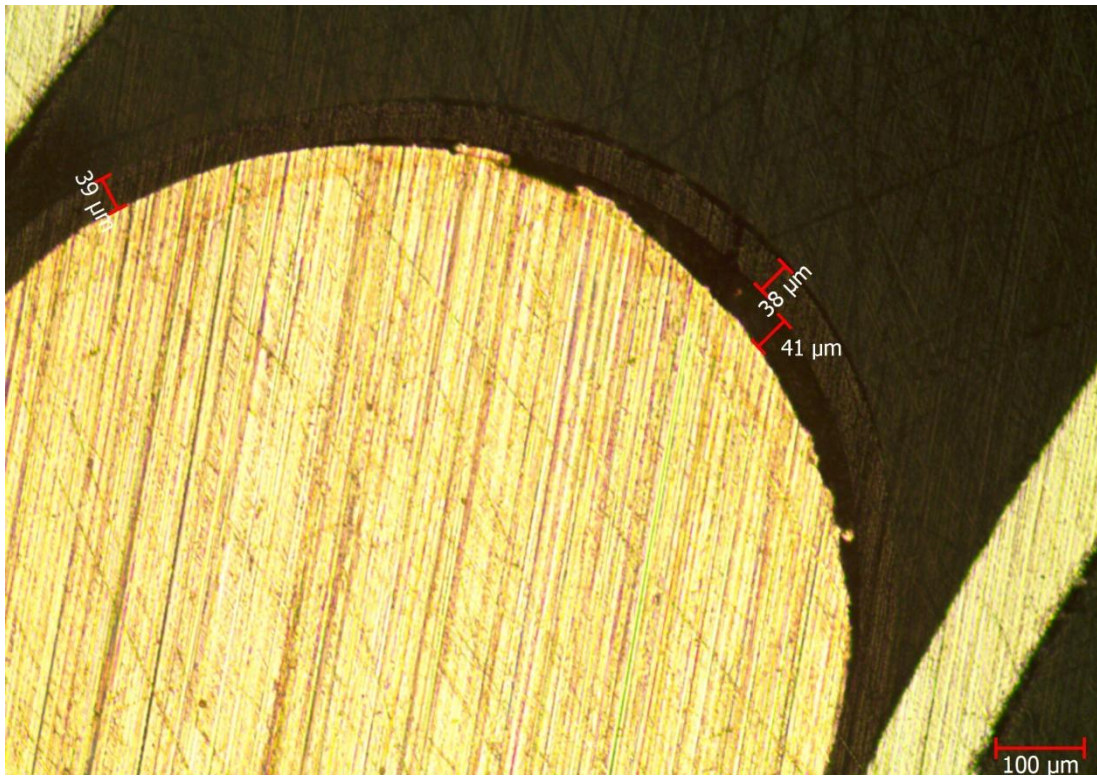
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NO 4:



50x

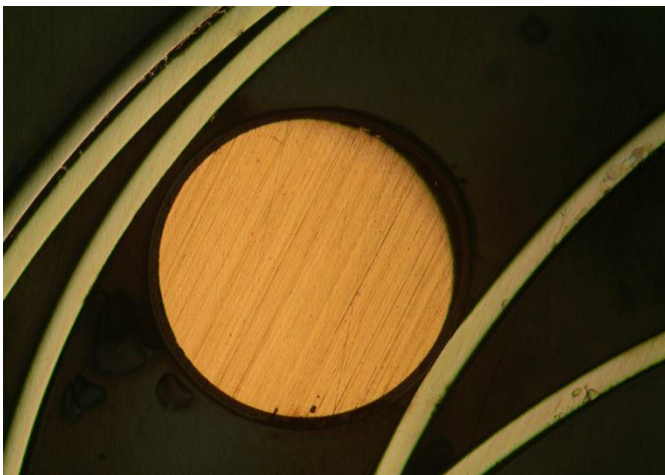
Coating measurement of NO 1:



100x

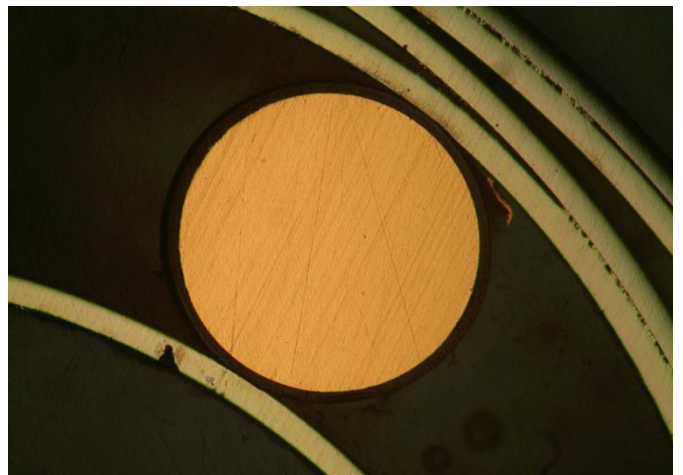
After the Metapo-B:

NO 1:



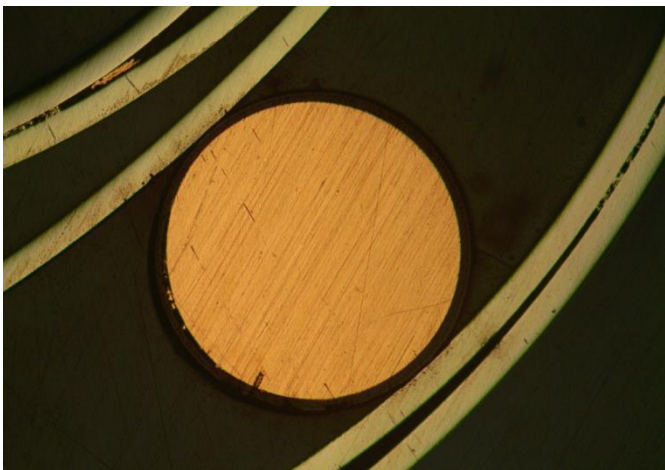
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NO 2:



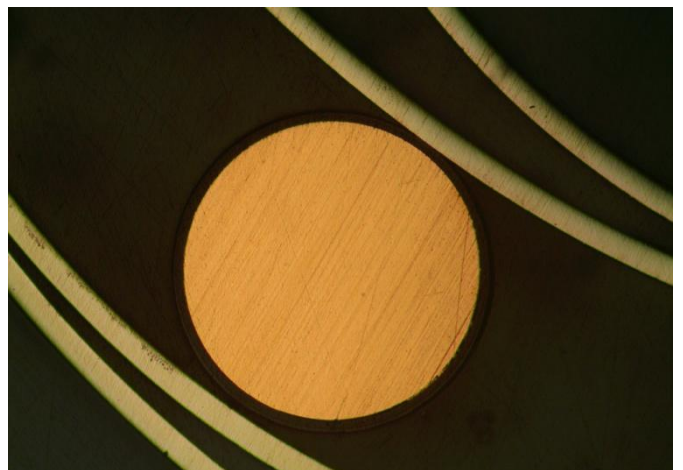
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NO 3:



50x

NO 4:



50x

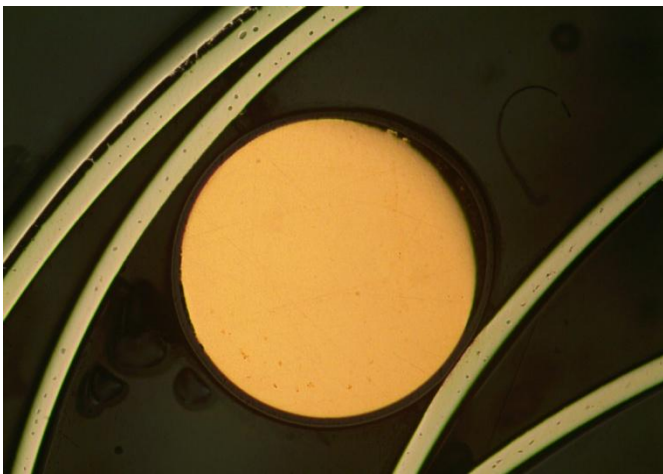
Coating measurement of NO 1:



100x

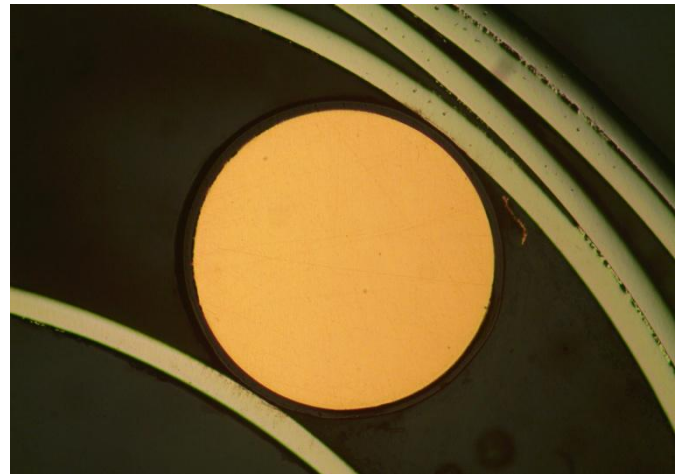
After the FEDO-1:

NO 1:



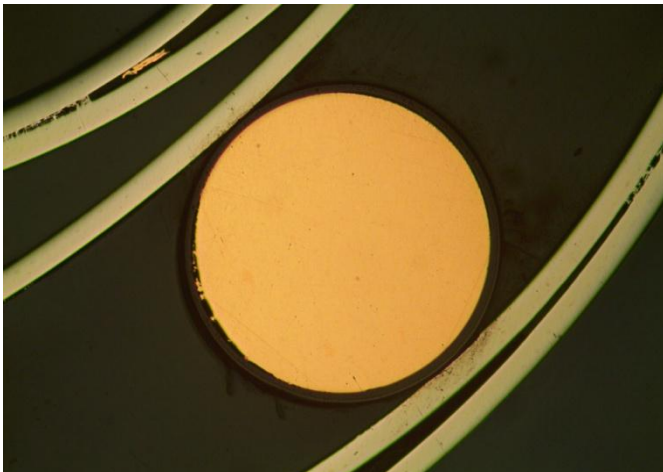
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NO 2:



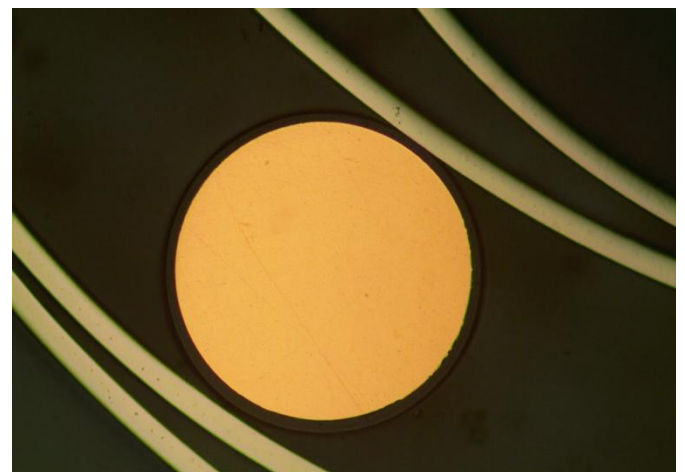
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NO 3:



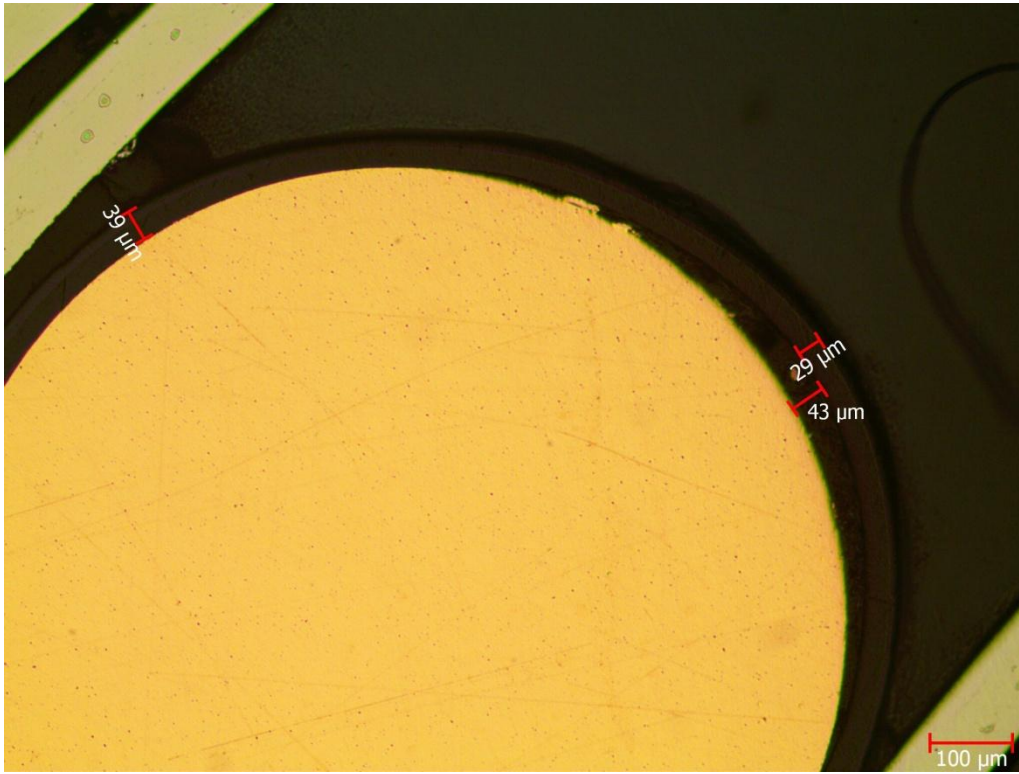
50x

NO 4:



50x

Coating measurement of NO 1:



100x



**metkon**<sup>®</sup>  
Technology behind Specimen

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**20**  
YEARS