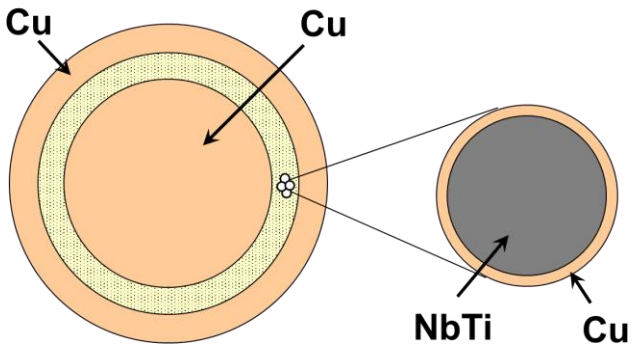
Furukawa's NbTi Wires

Specifications

Materials	Nb47wt%Ti filaments and Oxygen-Free Cupper (OFC) matrix
Properties	Critical temperature is 10K, critical field is 11T and used by being immersed in liquid helium or cooled with a cryocooler
Shape	Round and rectangular
Insulation	PVF (polyvinyl formal) and PAI (polyamide-imide), which has excellent radiation resistance, are possible
Cu/NbTi ratio	From 0.9 to 8.0
Filament diameter	From 5μm to 100μm
Twist pitch	Longer than ten times the wire diameter to prevent filament damage
Critical current density : Jc	Almost the same regardless of wire type, with values such as 3kA/mm²@5T and 1kA/mm²@8T
Special wires	Low AC loss wires with fine filaments, short twist pitch and high electrical resistance matrix are available Self-bonding wire coated with thermoplastic resin, is under development to achieve non-impregnated magnets

Typical Cross section



Applications and wire types

Application	Type	Cu/NbTi ratio	Filament diameter	Critical current	Stability	Sweep rate
MRI	F36/7.5 F54/4.6	Large	Large	Low	High	Small
MCZ	F336/4.3 F1752/2.4	Medium	Medium	Medium	Medium	Medium
Accelerator	F2100/0.9	Small	Small	High	Low	Large

NbTi Round & Rectangular Wires (standard)

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Type	Bare dia. mm	Insulasion thickness mm (PVF)	Cu/NbTi ratio	Filament number	Filament dia. mm	Ic@3T A	Ic@4T A	Ic@5T A	Ic@6T A	Ic@7T A	Ic@8T A	Minimum RRR	Minimum piece length m
F36/7.5	min:0.4	0.025-0.040	7.5	36	0.023	-	45	35	30	20	-	100	5,000
	max:1.2				0.069	-	425	350	275	205	-		5,000
F54/4.6	min:0.4		4.6	54	0.023	85	70	-	-	-	-		5,000
	max:1.2				0.069	810	650	-	-	-	-		5,000
F78/1.3	min:0.4		1.3	78	0.030	-	-	145	115	85	-		5,000
	max:1.2				0.088	-	-	1,340	1,090	830	-		2,000
F90/2.5	min:0.4		2.5	90	0.023	-	110	90	70	50	35		5,000
	max:1.2				0.068	-	1,020	830	655	480	315		2,000
F336/4.3	min:0.5		4.3	336	0.012	-	115	100	75	55	35		5,000
	max:1.2				0.028	-	690	575	455	335	215		5,000
F830/2.0	min:0.5		2.0	828	0.010	-	-	160	130	100	-		5,000
	max:1.2				0.024	-	-	930	750	580	-		5,000
F1740/2.4	min:0.85		2.4	1,752	0.011	-	565	455	365	270	185		3,000
	max:1.2				0.016	-	1,100	910	730	545	365		3,000
F2100/0.9	min:0.50		0.9	2,100	0.008	-	-	285	230	170	-		5,000
	max:1.2				0.019	-	-	1,655	1,335	985	-		2,000

NbTi Round & Rectangular Wires (standard)

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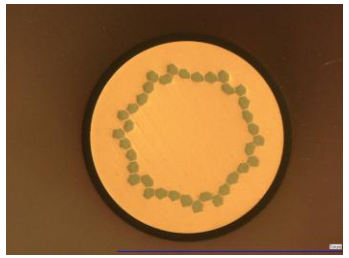
Type	Bare thickness/width mm	Insulation thickness mm (PVF)	Cu/NbTi ratio	Filament number	Filament dia. mm	Ic@3T A	Ic@4T A	Ic@5T A	Ic@6T A	Ic@7T A	Ic@8T A	Minimum RRR	Minimum piece length m
F54/4.8/60-100	0.60 / 1.00	0.03-0.05	4.8	54	0.048	-	310	250	195	-	-	70	5,000
F336/4.3/82-115	0.82 / 1.15		4.3	336	0.025	-	530	440	345	255	165		5,000
F830/2.0/90-180	0.90 / 1.80		2.0	828	0.017	-	-	1,540	1,200	900	-		5,000
F2100/1.0/45-75	0.45 / 0.75		0.95	2,100	0.010	680	560	-	-	-	-		3,000
F2100/1.0/60-100	0.60 / 1.00		0.95	2,100	0.013	1,200	1,000	840	-	-	-		3,000

Cross sections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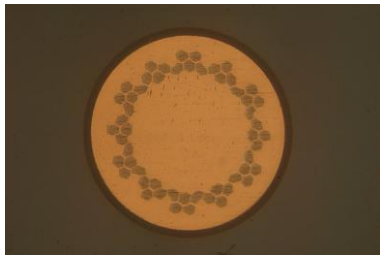
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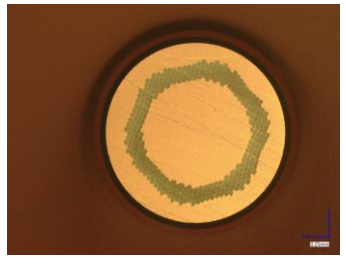
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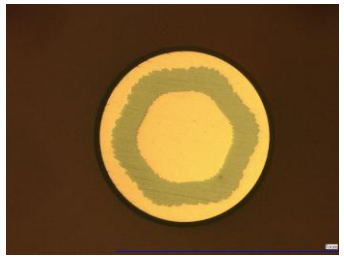
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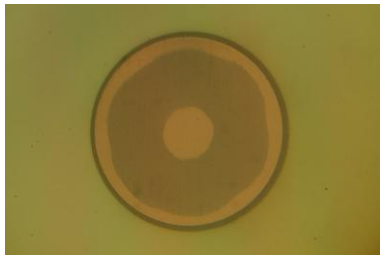
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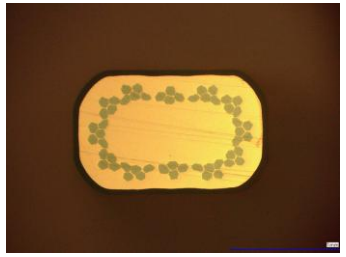
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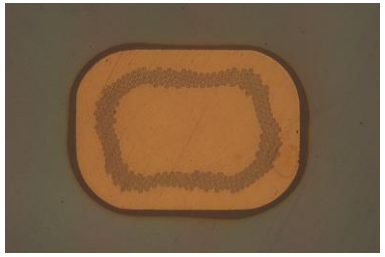
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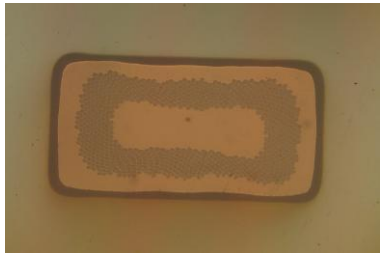

F830

F2100

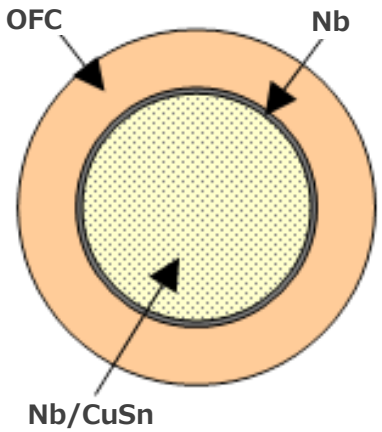
For other sizes, structures or properties, please contact us.

Furukawa's Nb_3Sn Wires

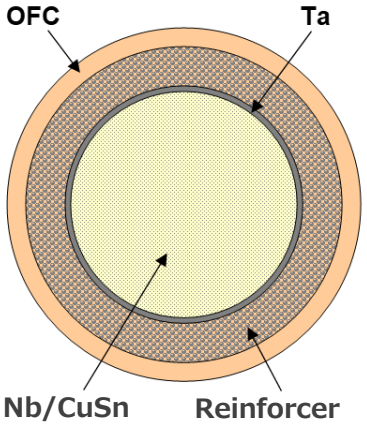
Specifications

Materials	Bronze-route Nb_3Sn wire with Nb filaments, CuSn matrix and stabilizer (OFC)
Properties	Critical temperature is 18K and critical field is 20T, used in coils that generate higher magnetic fields than NbTi
Shape	Round and rectangular
Insulation	E-glass braid
Copper fraction (volume)	From 18 to 50%
Filament diameter	From 2 to 10μm, with smaller filaments resulting in higher Jc
Non-Copper critical current density : Jc	Varies based on Sn concentration in CuSn, CuSn ratio (CuSn volume/Nb volume), filament diameter, and heat treatment condition. By using high Sn concentration CuSn, NSS-HJ types achieve high Jc
Special wires	NSS-HS types are less prone to Jc degradation even when strain is applied by composing reinforcer (CuNi/NbTi or CuNb) Among NSS-HS types, some can be used by react & wind method

Typical Cross Sections



NSS, NSS-HJ



NSS-HS

Applications and wire types

Application	Type	Reinforcer	nonCu-Jc	Yield strength
NMR ~600MHz	NSN	–	Low	–
NMR ~1GHz	NSS-HS	CuNi/NbTi	Medium	High
NMR >1GHz	NSS-HS	CuNi/NbTi CuNb	High	High
Nuclear fusion reactor	NSS-HJ	–	High	–

Nb_3Sn Round Wires (standard)

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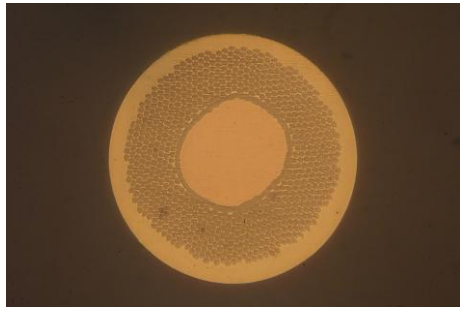
Type	Bare dia. mm	Insulation thickness mm (E-glass braid)	Stabilizer	Reinforcer	Cu fraction %	Filament dia. mm	Ic@10T A	Ic@12T A	Ic@14T A	Ic@16T A	Minimum RRR	Heat treatment condition	Minimum piece length m
NSN	min:0.6	0.075	OFC Internal	-	19	0.0024	-	120	80	-	120	A	2,000
	max:1.0					0.0040	-	305	205	-	120	A	2,000
NSS	1.0		OFC External		50	0.0043	290	210	-	-	100	A	2,000
NSS-HJ	min:0.6				23	0.0020	-	170	115	70	100	B	2,000
	max:1.0					0.0033	-	480	320	195	100	B	2,000
NSS-HS	0.8			CuNb between Cu & SC	20	0.0033	-	135	85	-	100	C	2,000

Heattreatment condition
A) 650℃/240hrs
B) 575℃/175hrs+650℃/125hrs
C) 670℃/96hrs

Cross sections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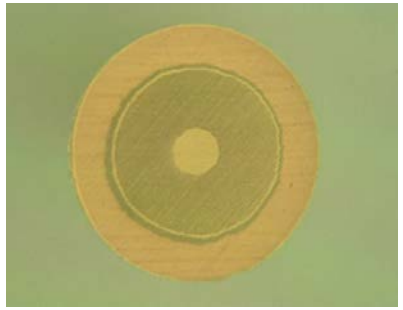
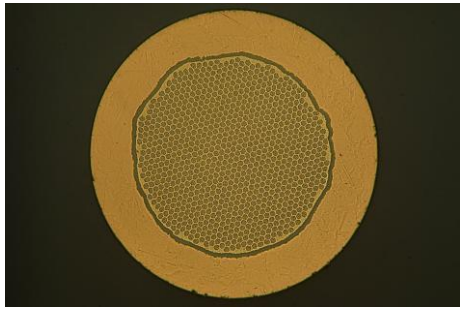
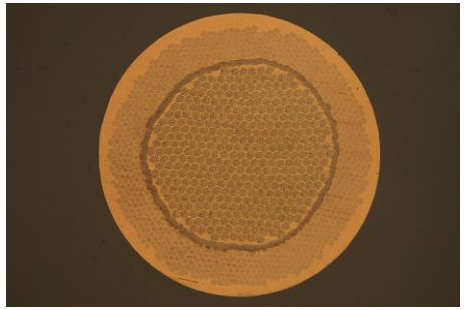

NSS


NSS-HJ


NSS-HS

For other sizes, structures or properties, please contact us.

Nb_3Sn Rectangular Wires (standard)

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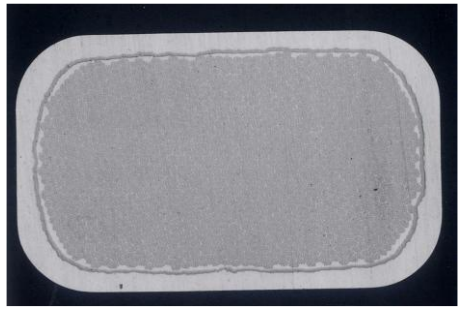
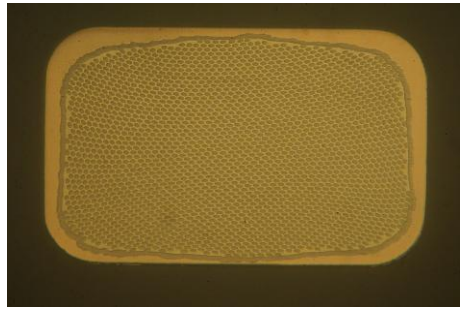
Type	Bare thickness/width mm	Insulation thickness mm (E-glass braid)	Stabilizer	Reinforcer	Cu fraction %	Filament dia. mm	Ic@11T A	Ic@12T A	Ic@14T A	Ic@16T A	Minimum RRR	Heat treatment condition	Minimum piece length m
NSS	0.90 / 1.35	0.075	OFC External	-	21	0.0039	-	470	335	220	100	C	2,000
	1.00 / 1.50					0.0043	-	580	400	270		C	2,000
	1.20 / 1.80					0.0038	-	840	575	390		C	2,000
	1.40 / 2.10					0.0045	-	1,130	775	520		C	2,000
NSS-HJ	1.36 / 2.20				20	0.0045	-	-	-	765		D	2,000
NSS-HS	0.90 / 1.35			CuNi/NbTi Center	21	0.0037	510	425	295	190		C	2,000
	1.00 /1.50				21	0.0041	640	535	365	235		C	2,000
	1.10 / 1.65				21	0.0046	780	655	450	285		C	2,000
	1.29 / 2.10			CuNb between Cu & SC	20	0.0042	-	-	-	400		D	2,000

Heattreatment condition
C) 670℃/96hrs
D) 575℃/250hrs+690℃/50hrs

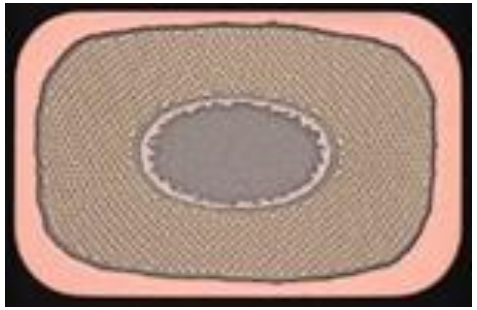
Cross sections



NSS



NSS-HJ



NSS-HS (CuNi/NbTi)

NSS-HS (CuNb)

For other sizes, structures or properties, please contact us.