



Metal Powders
Cubond® Brazing Paste

GlidCop®
Microbond Solder Paste

2601 Weck Drive Research Triangle Park, NC 27709
Voice: (919) 544-8090 Fax: (919) 544-7996

F A X T R A N S M I S S I O N

DATE: May 27, 1999

TO: FRANK DEPAOLA
ARGONNE NATIONAL LABORATORY

PHONE: 630-252-6392
FAX: 630-252-8742

FROM: Jack Troxell
Sales and Technical Service Manager-GlidCop

PHONE: 919-544-8090
FAX: 919-544-7996

Pages including fax cover sheet 6

Message:



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May 27, 1999

Mr. Frank Depaola
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Dear Frank,

Thank you for your interest in GlidCop® Aluminum Oxide Dispersion Strengthened Copper.

Please find enclosed, technical information, which describes the features of GlidCop® as well as typical sizes produced by OMG.

GlidCop®'s unique combination of properties includes high strength, high electrical thermal conductivity, and a unique resistance to thermal softening. GlidCop® provides you the opportunity to design your special parts with a high performance copper material unmatched by any other copper alloy system.

Again, thank you for taking the time to discuss GlidCop®. Please feel free to contact me if you should have further questions. I may be reached at (919) 544-8090, extension 229, or contact Tim Creech, Customer Service Representative at (919)544-8310.

Best regards,

Jack D. Troxell
Sales and Technical Service Manager-GlidCop®

JDT/scd

Enclosure



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TECHNICAL DATA

GLIDCOP® DISPERSION STRENGTHENED COPPER GLIDCOP® AL-15 (C15715)

APPLICATIONS

The AL-15 grade is primarily designed for applications requiring the highest electrical and thermal conductivities along with good elevated temperature strength. GlidCop® AL-15 has excellent cold working characteristics, and can be drawn into fine wire or rolled into thin sheets.

GlidCop® AL-15 is recommended for hybrid circuit package components; vacuum tube, microwave tube, and X-ray tube components such as anodes, grids, cathodes, helices, and heat sinks; electrical components such as circuit breakers, relay blades, and switches; rotating equipment components such as commutators, electric generator and motor components, and brush springs; and high power magnet windings.

For applications requiring brazed joints and/or extended high temperature exposure in hydrogen containing atmospheres or vacuum, Low Oxygen* (LOX) GlidCop® is available and recommended.

DESCRIPTION

GlidCop® AL-15 is a low alumina content grade of dispersion strengthened copper. It consists of a pure copper matrix containing finely dispersed sub-microscopic particles of Al_2O_3 which act as a barrier to dislocation movement. The dispersed Al_2O_3 is thermally stable so that it acts to retard recrystallization of the copper. Consequently, significant softening does not occur as the result of high temperature exposure. Along with superior strength retention, thermal and electrical conductivities are higher than conventional copper alloys.

GlidCop® AL-15 is designated in UNS as C15715. This grade is available as rod and bar stock, strip and strip reroll, wire redraw, plates and large rounds. Most forms are available with or without an oxygen free copper cladding. Unless specified as "declad", GlidCop® is supplied with cladding.

COMPOSITION

GlidCop® AL-15
Aluminum: 0.15% by wt. as Al_2O_3 Copper: Balance
*Note: Low Oxygen GlidCop® contains nominally 250 ppm boron.

PHYSICAL PROPERTIES

Melting Point	1083°C	1981°F
Density	8.90 g/cm ³ at 20°C	0.321 lbs./in ³ at 68°F
Electrical Conductivity	0.533 micro mho-cm at 20°C	92% IACS at 68°F
Thermal Conductivity	365 W/m ² /K at 20°C	211 Btu/ft ² /ft/hr/°F at 68°F
Electrical Resistivity	1.86 micro ohm-cm at 20°C	11.19 Ohm circular-mil/ft. at 68°F
Coefficient of Thermal Expansion	16.6 μm/m/°C (20-150°C)	9.2 μin/in/°F (68-300°F)
Modulus of Elasticity (Tension)	130 GPa	19 x 10 ⁶ psi

MECHANICAL PROPERTIES

TYPICAL ROOM TEMPERATURE PROPERTIES OF GLIDCOP® AL-15									
Shapes	Thickness or Dia.		Temper or Condition	Tensile Strength		Yield Strength		Elongation (%)	Hardness (HRB)
	(mm)	(in)		(MPa)	(ksi)	(MPa)	(ksi)		
Flat Products	10	(.400)	As Cons. #	413	(60)	331	(48)	20	62
	1.3	(.050)	CW* 88%	579	(84)	537	(78)	7	-
	.6	(.025)	CW 94%	620	(90)	579	(84)	7	-
	.15	(.006)	CW 98%	661	(96)	613	(89)	6	-
	.15	(.006)	Temper 70	517	(75)	483	(70)	10	-
	.15	(.006)	Temper 80	586	(85)	551	(80)	8	-
Plate	Up to 130	(5.0)	As Cons.	365	(53)	255	(37)	26	62
	25	(1.0)	CW 60%	476	(69)	427	(62)	10	-
	16	(.625)	CW 75%	483	(70)	455	(66)	10	-
Rod	29	(1.125)	As Cons.	393	(57)	324	(47)	27	62
	19	(.75)	CW 55%	427	(62)	407	(59)	18	68
	7	(.275)	CW 94%	496	(72)	469	(68)	9	72
Wire	1.3	(.050)	CW 99%	524	(76)	496	(72)	2	-
	1.3	(.050)	HT* 650°C	400	(58)	351	(51)	10	-
	.4	(.015)	CW 99.9%	606	(88)	579	(84)	1	-
Rounds	Up to 760	(30)	As Cons.	365	(53)	255	(37)	26	-

#As Consolidated

*Cold Work: % reduction in area

*Heat treatment for 1 hour

MATERIAL SAFETY DATA

See MSDS before using this product.

SAMPLES AND SERVICES

For further information or sample quantities for test, contact our Customer Service Department.

The recommendations and suggestions given in this data sheet are made without any representation of warranty, expressed or implied, in law or fact, and upon the condition that purchasers make their own tests to determine the suitability of such products for their particular purposes. Statements concerning the possible use of the products or processes described are not intended as recommendations or permission to use the same in the infringement of any patent or to practice a patented invention without a license.

OMG Americas · 2601 Weck Drive · Box 12166 · Research Triangle Park, NC 27709-2166, USA
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STANDARD SHAPES AND SIZES AVAILABLE

Shape and Size (inches)	GlidCop® Grade			Standard Length (feet)	Weight per ft. (pounds)
	AL-15	AL-25	AL-60		
Drawn Rectangles					
0.125 x 0.250	Yes	No	No	8.2	0.12
0.250 x 0.250	Yes	No	No	"	0.24
0.250 x 0.500	No	No	Yes	"	0.48
0.500 x 0.500	No	No	Yes	"	0.96
0.500 x 1.000	No	No	Yes	"	1.92
0.750 x .0750	No	No	Yes	"	2.20
0.750 x 1.000	No	No	Yes	"	2.90
1.000 x 1.000	No	No	Yes	"	3.80
Drawn Rod Diameters					
0.125	Yes	Yes	Yes	8.2	0.05
0.250	Yes	Yes	Yes	"	0.19
0.375	Yes	Yes	Yes	"	0.42
0.500	Yes	Yes	Yes	"	0.75
0.625	Yes	Yes	Yes	"	1.17
0.750	Yes	Yes	Yes	"	1.68
1.000	Yes	Yes	Yes	"	3.01
1.250	Yes	No	Yes	6	4.70
Extruded Rod					
1.500	Yes	Yes	Yes	6.5	6.80
1.750	Yes	No	Yes	"	9.24
2.000	Yes	Yes	Yes	"	12.00
2.500	Yes	Yes	Yes	"	18.85
3.000	Yes	No	No	"	27.14
4.250	No	Yes	No	76 inch	54.47
6.250	No	Yes	No	"	117.80
Extruded Rectangle					
.340 x 4.4	Yes	Yes	Yes	6.5	5.70
.375 x 2.2	Yes	Yes	Yes	"	3.20
.500 x 6.375	Yes	Yes	Yes	"	12.20
1.00 x 1.25	No	No	Yes	"	4.79
1.15 x 3.04	Yes	No	Yes	"	13.42
1.125 x 5.00	Yes	No	No	"	21.60
1.300 x 1.60	Yes	Yes	Yes	"	7.99
1.500 x 3.625	Yes	No	Yes	"	20.88
1.960 x 2.36	No	No	Yes	"	17.76
2.050 x 2.85	No	No	Yes	"	22.43
2.500 x 2.0	Yes	Yes	No	1 min	192.00
3.500 X 4.500	Yes	No	No	"	61.00
Drawn Wire					
0.040	Yes	No	No	10# spool	0.0048
0.060	Yes	No	No	10# spool	0.0108
0.100	Yes	No	No	10# spool	0.0301

Most sizes listed above are in stock. If not, lead times of 6-18 weeks may be required for some items. Many other sizes are also available that do not appear in this list. Custom sizes may also be available subject to tooling and equipment requirements and minimum quantities required. Most sizes listed are CLAD GlidCop® products, although DECLAD sections can be supplied in larger section sizes based on the customer's end requirements. LOX versions of each grade are available, with LOX being standard for AL-15, and a special order for AL-25 and AL-60.

MATERIAL SAFETY DATA

See MSDS before using any of these products.

The recommendations and suggestions given in this data sheet are made without any representation of warranty, expressed or implied, in law or fact, and upon the condition that purchasers make their own tests to determine the suitability of such products for their particular purposes. Statements concerning the possible use of the products or processes described are not intended as recommendations or permission to use the same in the infringement of any patent or to practice a patented invention without a license.

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GLIDCOP® SIZE, STRAIGHTNESS, & LENGTH TOLERANCES

DRAWN ROD, BAR, AND WIRE

EXTRUDED ROD AND BAR

DIAMETER* (IN INCHES)	TOLERANCES +/- (IN INCHES)	STRAIGHTNESS (MAX. BOW IN INCHES)
Up to .010 incl.	.0002	1/2 in 10' Length
Over .010 to .020 incl.	.0003	"
Over .020 to .030 incl.	.0005	"
Over .030 to .040 incl.	.0007	"
Over .040 to .050 incl.	.0008	"
Over .050 to .060 incl.	.0010	"
Over .080 to .500 incl.	.0020	"
Over .500 to 1.00 incl.	.0030	"
Over 1.00 to 2.00 incl.	.0040	"
Over 2.00	.0060	"

DIAMETER* (IN INCHES)	TOLERANCES +/- (IN INCHES)
Up to 1.00 incl.	.020
Over 1.00 to 2.00 incl.	.030
Over 2.00 to 3.00 incl.	.050
Over 3.00 to 3.50 incl.	.070
Over 3.50 to 4.00 incl.	.120
Over 4.00 to 10.00 incl.	.183

*Diameter or distance between parallel surfaces

ROLLED STRIP AND PLATE

THICKNESS TOLERANCES +/-					WIDTH TOLERANCES +/-				
WIDTHS (IN INCHES)					THICKNESS (IN INCHES)				
THICKNESS (IN INCHES)	Up to 8 incl.	Over 8 to 12 incl.	Over 12 to 14 incl.	Over 14 to 20 incl.	WIDTH (IN INCHES)	.004 to .032 incl.	Over .032 to .125 incl.	Over .125 to .188 incl.	Over .188 to .500 incl.
Up to .013 incl.	.0010	.0015	.0015	.0025	Up to 2 incl.	.005	.010	.012	.015
Over .013 to .017 incl.	.0013	.0020	.0020	.0025	Over 2 to 8 incl.	.008	.013	.015	.015
Over .017 to .021 incl.	.0015	.0025	.0025	.0030	Over 8 to 18 incl.	1/64	1/64	1/64	1/32
Over .021 to .026 incl.	.0020	.0025	.0025	.0030					
Over .026 to .037 incl.	.0025	.0030	.0030	.0035					
Over .037 to .050 incl.	.0030	.0035	.0035	.0040					
Over .050 to .073 incl.	.0035	.0040	.0040	.0045					
Over .073 to .130 incl.	.0040	.0045	.0045	.0050					
Over .130 to .188 incl.	.0045	.0050	.0050	.0060					
Over .188 to .205 incl.	.0045	.0050	.0050	.0060					
Over .205 to .300 incl.	.0050	.0060	.0060	.0070					
Over .300 to .500 incl.	.0060	.0070	.0070	.0080					
Over .500 to .750 incl.	.0080	.0100	.0100	.0120					
Over .750 to 1.00 incl.	.0100	.0120	.0120	.0150					
Over 1.00 to 1.50 incl.	.0280	.0280	.0280	.0280					
Over 1.50 to 2.00 incl.	.0330	.0330	.0330	.0330					

Common Tolerances for Rolled Plate: Up to and including 1 inch thick in 6 feet. Over 1 inch thick to 3/8 inch in 6 feet.

LENGTH TOLERANCES FOR DRAWN or ROLLED ROD or FLATS

SPECIFIC LENGTHS		LENGTHS WITH ENDS			
Lengths	Length Tolerances (full lengths only)	Diameter for Distance between parallel surfaces	Nominal Length (in feet)	Shortest Length Permitted (% nominal)	Maximum Permitted Weight of ends (% of lot weight)
Specific Length	+ 3/8", - 0	Up to 1/2" incl.	6 to 12	65	30
Specific Length with ends	+ 1", - 0	Over 1/2" to 1" incl.	6 to 12	60	40
		Over 1" to 1-1/2" incl.	6 to 10	50	50
		Over 1-1/2" to 2" incl.	6 to 10	40	60

Length tolerance for extruded rods or flats must be specified by the buyer subject to acceptance by OMG Americas, at the time the order is placed. Otherwise, there are no applicable specifications for extruded rod length tolerance.

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