



Copper, Challenge and Future

**WONIL** Wonil

231-4, Nonhyeon-dong, Gangnam-gu, Seoul, Korea Tel: 02-2631-1242~4 Fax: 02-2631-1245  
602-22BL, 647, Seonggok-dong, Danwon-ku, Ansan City, Kyeonggi-Do(425-834) Tel:031-491-2891~5 Fax: 031-491-5012

**Sewon**

602-4BL, 646-3, Seonggok-dong, Danwon-ku, Ansan City, Kyeonggi-do(425-834)  
Tel: 031-495-0107, 031-495-9340~2 Fax: 031-495-6651 <http://www.wonilsa.co.kr>

# ● Oxygen Free High Conductivity Copper

## ● Oxygen Free with Silver Copper



### 1. Definition

- The oxygen free high conductivity copper is the highest grade of pure copper. The copper is over 99.99 percent pure, has oxygen contents below 0.0010 percent and has electrical conductivity of over 101 percent IACS. It has good solderability, weatherability, formability, malleability, and corrosion resistance as well as excellent electrical and thermal conductivity. Although it is heated up high temperature in the deoxidizing atmosphere, it does not occur hydrogen embrittlement.
- Silver(Ag) is an element which has the highest electrical conductivity. If small amounts of silver are added to the oxygen free high conductivity copper, it will improve the heat resistance without deteriorating electrical conductivity.

### 2. Demand

- lead frame, sputtering target, magnetron, lead wire, connector, terminal, bus bar, switch, boiler, radiator, gasket, coaxial cable, coaxial tube, vacuum tube, X ray tube, microwave tube, coil for transformer winding, coil for induction furnace, gasket for vacuum apparatus, transistor component, radio component, conductivity wire, commutator, combining terminal by compression, heat exchanger, vacuum circuit breaker, large capacity generator, chemical process equipment, marine growth preventing system

### 3. Chemical composition

Unit : %

Element Alloy No.	Cu	Pb	Fe	Sn	Zn	P	O <sub>2</sub>
C1020	99.96 min.	–	–	–	–	–	0.0010 max.
	99.975 min.	–	–	–	–	–	0.0010 max.

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Element Alloy No.	Cu + Ag	Pb	Fe	Sn	Zn	Ag	O <sub>2</sub>
C10400	99.95 min.	–	–	–	–	0.027 min.	0.0010 max.
	99.975 min.	–	–	–	–	0.030 min.	0.0010 max.
C10500	99.95 min.	–	–	–	–	0.034 min.	0.0010 max.
	99.975 min.	–	–	–	–	0.035 min.	0.0010 max.
C10700	99.95 min.	–	–	–	–	0.085 min.	0.0010 max.
	99.975 min.	–	–	–	–	0.085 min.	0.0010 max.

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### 4. Product dimension

Unit : mm

	Plate			Coil		
	Thickness	Width	Length	Thickness	Width	Length
C1020	0.3 ~ 120.0	50 ~ 900	L	0.05 ~ 4.0	10 ~ 400	L
C10400·C10500·C10700	0.3 ~ 120.0	50 ~ 900	L	0.05 ~ 4.0	10 ~ 400	L

	Billet		Slab		
	Out-Diameter	Length	Thickness	Width	Length
C1020	190 ~ 200	3,000 ~ 4,000	120	400	4,000
C10400·C10500·C10700	190 ~ 200	3,000 ~ 4,000	125	400	4,000



## Greetings from the Chairman

The Wonil Co., Ltd. was established in 1968 and has been the producer of zinc plates for printing. We have been producing the plates and coils of copper and brass as our main products, achieving the Korean Industrial Standards Mark in 1993. With the motto, "Let us do our best with sincerity" for the past 40 years, we have devoted ourselves solely to the non-ferrous metal rolling industry.

We owe our continuous growth for these past 40 years to your great concern and support. In return, we want to express our deepest appreciation to you. All of us at the Wonil family have dedicated ourselves to continuously supplying you with the top quality products at lowest prices.

We will guarantee our superiority in speed and quality by improving our labor productivity. This will be based upon the balance between labor, capital, and the flexible manufacturing system. This will enable us to achieve multi-line small quantity production and international competitiveness as a company specializing in copper through the introduction of advanced technology and the continual investment into research and development.

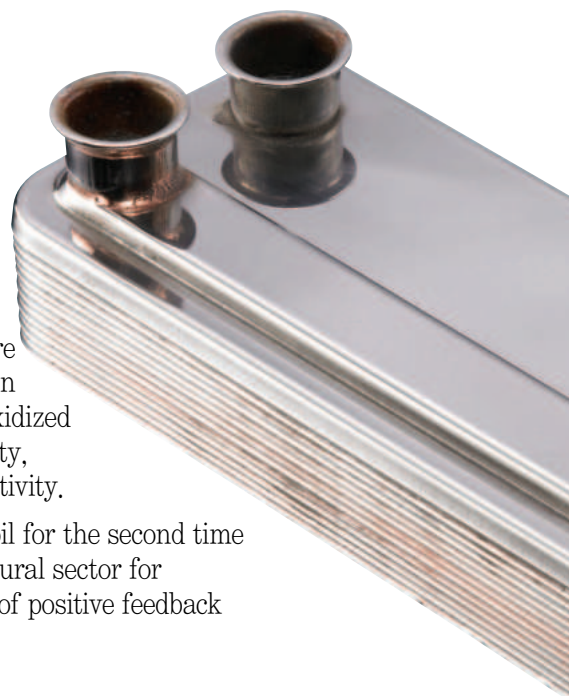
The associated company, the Sewon Advanced Metals Co., Ltd., which was established in 2002, succeeded in mass production of phosphore bronze and copper-iron alloy. Furthermore, we intend to play a big part in the related industry through the development of a higher value-added copper alloy and rolling technology such as copper-chrome, multi-gauge strips.

By continuing our 40-year tradition of field-based technology management and meeting the demands of the new times, we will be able to maintain our competitive power in the 21st-century as the leading technology-intensive venture business, specializing in copper and copper alloys. We will reward for your support and contribute to the economic growth of Korea.

Eui-Chil, Shim  
Chairman of Wonil Co., Ltd.



# ● Phosphorus Deoxidized Copper



## 1. Definition

- We produce our phosphorous deoxidized copper by deoxidizing the fused copper by dissolving the highly pure raw materials with phosphorous while keeping the oxygen contents below 0.01 percent. Thus, our phosphorous deoxidized copper is excellent in formability, malleability, solderability, corrosion resistance, weatherability, and thermal conductivity.
- We have produced and supplied the 600mm wide copper coil for the second time in Korea. There has been a high demand in the architectural sector for its interior and exterior materials. We have received lots of positive feedback from our customers.

## 2. Demand

- roofing, roofing tile, spout, gutter, down spout, vessel, heat exchanger, air conditioner, refrigerator, boiler, radiator, gasket, resistance welding equipment

## 3. Chemical composition

Unit : %

Element Alloy No.	Cu	Pb	Fe	Sn	Zn	P	O <sub>2</sub>
C1201	99.90 min.	-	-	-	-	0.004 min. 0.015 max.	-
	99.90 min.	-	-	-	-	0.004 min. 0.015 max.	-
C1220	99.90 min.	-	-	-	-	0.015~0.04	-
	99.90 min.	-	-	-	-	0.015~0.04	-
C1221	99.75 min.	-	-	-	-	0.004~0.04	-
	99.75 min.	-	-	-	-	0.004~0.04	-

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## 4. Product dimension

Unit : mm

	Plate			Coil		
	Thickness	Width	Length	Thickness	Width	Length
C1201 C1220 C1221	0.3 ~ 90.0	100 ~ 900	L	0.05 ~ 4.0	10 ~ 600	L

	Billet		Slab		
	Out-Diameter	Length	Thickness	Width	Length
C1201 C1220 C1221	-	-	100	400	3,500
			90	600	



# ● Tough Pitch Copper

## 1. Definition

- The tough pitch copper has high electrical conductivity and has excellent mechanical and physical properties.
- As a result, we have selected this raw materials for its high purity, removing any impurities by controlling the oxygen content through atmosphere controls.



## 2. Demand

- bus bar, gasket, connector, terminal, switch, magnet wire, bus duct, dry coil, radiator, rivet, heat exchanger, roofing, spout, distributing board, coil for transformer winding, circuit breaker, radio component, pressure vessel, chemical process equipment

## 3. Chemical composition

Unit : %

Element Alloy No.	Cu	Pb	Fe	Sn	Zn	P	O <sub>2</sub>
C1100	99.90 min.	–	–	–	–	–	–
	99.96 min.	–	–	–	–	–	–

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## 4. Product dimension

Unit : mm

	Plate			Coil		
	Thickness	Width	Length	Thickness	Width	Length
C1100	0.3 ~ 90.0	50 ~ 900	L	0.05 ~ 4.0	10 ~ 600	L

	Billet		Slab		
	Out-Diameter	Length	Thickness	Width	Length
C1100	190 ~ 200	3,000 ~ 4,000	100	400	3,500
			90	600	



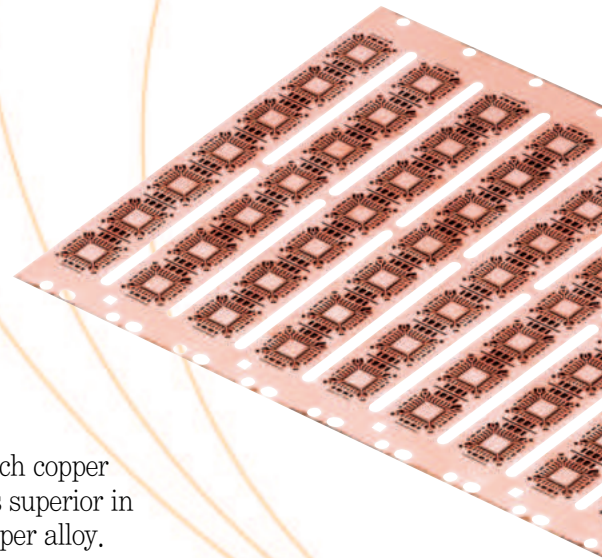
Edge of a Copper Strip

## Tough Pitch Copper for Transformer Winding

Due to the tough pitch copper's purity of over 99.96 percent, it has excellent electrical conductivity. This has been the main reason for the high quality of the copper coil used in the transformer free from burr. It has allowed us to produce and supply our customers with the perfect copper coils for transformer.



## ● Cu-Fe alloy



### 1. Definition

- Conventionally, an iron-contained copper alloy in which copper is added with iron(Fe), phosphorous(P), and zinc(Zn) is superior in conductivity and is well known as a high strength copper alloy.
- We have produced and supplied the plates and coils of predominant hardness and electrical conductivity through appropriate cold rolling and aging conditions.

### 2. Demand

- connector, lead frame, relay, clamp, fuse clip, terminal, rivet, contact spring, circuit breaker component

### 3. Chemical composition

Unit : %

Element Alloy No.	Cu	Zn	Pb	Fe	P	Sn	Cu+Fe+P
C19210	–	–	–	0.05~0.15	0.025~0.04	–	99.8 min.
	–	–	–	0.1	0.03	–	99.8 min.
C19400	97.0 min.	0.05~0.20	0.03 max.	2.1~2.6	0.015~0.15	–	–
	97.0 min.	0.15	0.03 max.	2.4	0.04	–	–

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### 4. Product dimension

Unit : mm

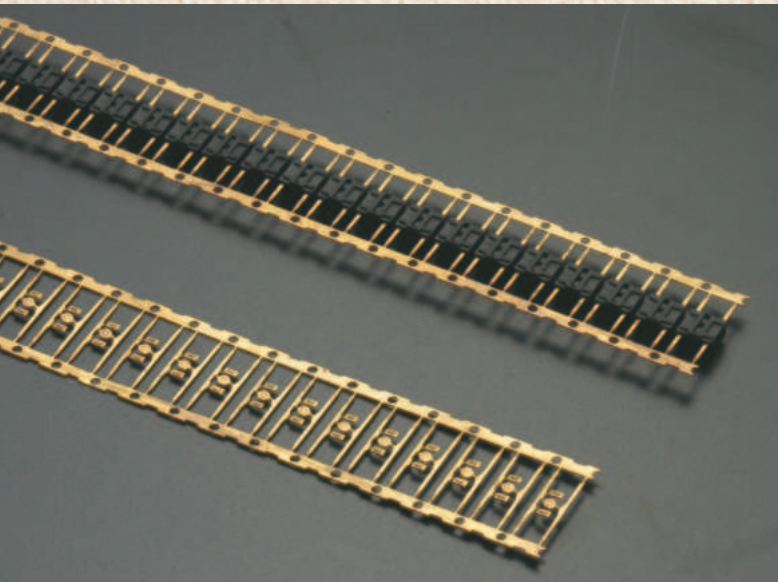
	Plate			Coil		
	Thickness	Width	Length	Thickness	Width	Length
C19210	0.5 ~ 3.0	10 ~ 380	L	0.05 ~ 2.4	10 ~ 380	L
C19400	0.5 ~ 3.0	10 ~ 380	L	0.1 ~ 2.4	10 ~ 380	L

### 5. Mechanical properties

	Temper	Tensile Strength (N/mm <sup>2</sup> )	Elongation(%)	Vickers Hardness (Hv)	Electrical Conductivity (%IACS) @20℃
C19210	1/2H	295 ~ 375	10 min.	100 ~ 125	85 min.
	H	330 ~ 415	5 min.	110 ~ 135	85 min.
	EH	370 min.	–	115 min.	85 min.
C19400	1/2H	365 ~ 435	5 min.	115 ~ 137	60 min.
	H	415 ~ 480	2 min.	125 ~ 145	60 min.
	EH	460 ~ 505	–	135 ~ 150	60 min.
	SH	480 ~ 525	–	140 ~ 155	60 min.
	ESH	505 ~ 550	–	145 ~ 160	60 min.



# Brass



## 1. Definition

- Brass is an alloy of copper. It is composed of 60–70 percent copper and 30–40 percent zinc. It has excellent properties such as flatting, drawing, shearing, plating, and corrosion resistance.
- We have produced and supplied various types of alloys and met specifications in order to meet our customers' demands.

## 2. Demand

- connector, screw, spring, radiator, rivet, pin, pump, terminal, antenna, door knob, hinge, watch, heat exchanger, lamp socket, lock, brass, harmonica

## 3. Chemical composition

Unit : %

Element Alloy No.	Cu	Pb	Fe	Sn	Zn	P	O <sub>2</sub>
C2600	68.5~71.5	0.05 max.	0.05 max.	–	rem.	–	–
	69.1~69.6	0.01 max.	0.015 max.	–	rem.	–	–
C2680	64.0~68.0	0.05 max.	0.05 max.	–	rem.	–	–
	64.0~64.5	0.01 max.	0.025 max.	–	rem.	–	–
C2720	62.0~64.0	0.07 max.	0.07 max.	–	rem.	–	–
	62.3~62.8	0.07 max.	0.05 max.	–	rem.	–	–
C2801	59.0~62.0	0.10 max.	0.07 max.	–	rem.	–	–
	60.3~60.8	0.10 max.	0.07 max.	–	rem.	–	–

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## 4. Product dimension

Unit : mm

	Plate			Coil		
	Thickness	Width	Length	Thickness	Width	Length
C2600 C2680 C2720 C2801	0.3 ~ 90.0	100 ~ 900	L	0.1 ~ 4.0	10 ~ 400	L



## ● Copper bus bar

### 1. Definition

- The bus bar is a conducting bar that carries heavy currents to supply several electric circuits.
- We have produced and supplied various types of dimensions and met specifications in order to meet our customers' demands.

### 2. Demand

- switch, conductor, distributing board, circuit breaker, large capacity power main line, distributing wire instrument

### 3. Chemical composition

Unit : %

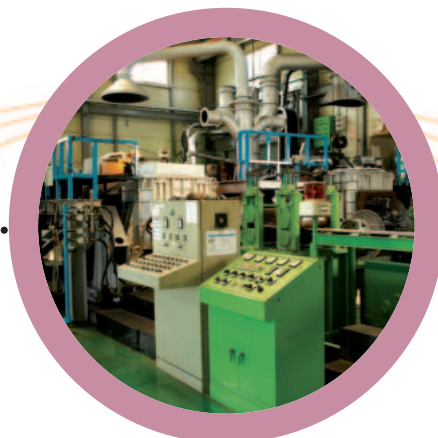
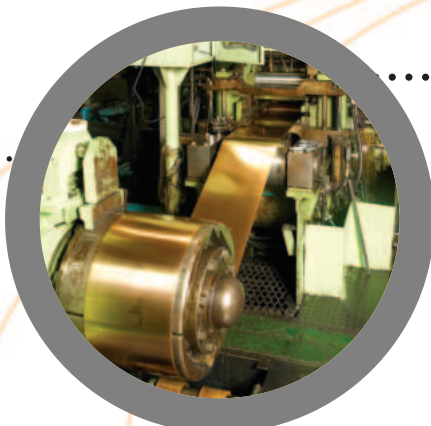
Alloy No.	Element	Cu	Pb	Fe	Sn	Zn	P	O <sub>2</sub>
C1020		99.96 min.	-	-	-	-	-	-
		99.975 min.	-	-	-	-	-	0.0010 max.
C1100		99.90 min.	-	-	-	-	-	-
		99.96 min.	-	-	-	-	-	-

☐ KS    ☒ SEWON

### 4. Product dimension

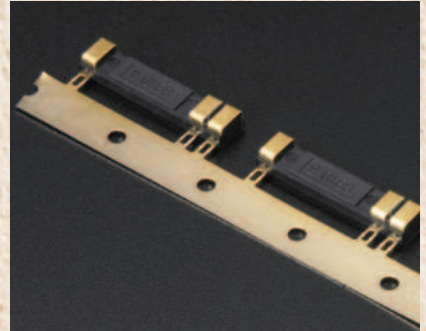
Unit : mm

	Round Type			Square Type		
	Thickness	Width	Length	Thickness	Width	Length
C1020 C1100	2.0 ~ 25.0	12 ~ 200	L	3.0 ~ 88.6	9 ~ 200	L





# ● Phosphor Bronze



## 1. Definition

- The phosphor bronze, which is composed of copper, tin, and phosphorous, is widely used in the electrical parts. It does not contain oxidized tin because phosphorous is added to copper for deoxidation. Our phosphor bronze is excellent in fatigue and corrosion resistance, formability, and malleability.

## 2. Demand

- terminal, connector, switch, lead frame, bush, fuse clip, spring, bellows, diaphragm, ball bearing, relay

## 3. Chemical composition

Unit : %

Element Alloy No.	Cu	Zn	Pb	Fe	P	Sn	Cu+Sn+P
C5111	-	0.20 max.	0.05 max.	0.10 max.	0.03~0.35	3.5 ~ 4.5	99.5 min.
	-	0.20 max.	0.05 max.	0.10 max.	0.15	4.0	99.5 min.
C5102	-	0.20 max.	0.05 max.	0.10 max.	0.03~0.35	4.5 ~ 5.5	99.5 min.
	-	0.20 max.	0.05 max.	0.10 max.	0.15	4.9	99.5 min.
C5191	-	0.20 max.	0.05 max.	0.10 max.	0.03~0.35	5.5 ~ 7.0	99.5 min.
	-	0.20 max.	0.05 max.	0.10 max.	0.15	6.1	99.5 min.
C5212	-	0.20 max.	0.05 max.	0.10 max.	0.03~0.35	7.0 ~ 9.0	99.5 min.
	-	0.20 max.	0.05 max.	0.10 max.	0.15	8.0	99.5 min.
C5210	-	0.20 max.	0.05 max.	0.10 max.	0.03~0.35	7.0 ~ 9.0	99.7 min.
	-	0.20 max.	0.05 max.	0.10 max.	0.15	8.0	99.7 min.

□ KS    ■ SEWON

## 4. Product dimension

Unit : mm

	Plate			Coil		
	Thickness	Width	Length	Thickness	Width	Length
C5111 · C5102 · C5191 · C5212 · C5210	0.5 ~ 8.0	30 ~ 270	2,400	0.15 ~ 2.0	10 ~ 270	L



## ● Research & Development Project

No.	Business	Development Project	Period	Accomplishment
1	Industry-Education-Research Collaboration Technology Development Business	Ready-Coated Process Development of Brazing Filling Material	May 1991 – April 1992	Finished Patent No. 091578
2	Industry-Education-Research Collaboration Technology Development Business	New Material Alloy Development of Electric Appliance of Copper System	June 1998 – May 1999	Finished
3	Ground Industrial Technology Development Business	Manufacturing and Applying Technology Development of Highly Functional Oxygen Free High Conductivity and Silver Alloyed Copper	May 1999 – April 2001	Finished Utility Model No. 0217173 Utility Model No. 0223393
4	Technology Innovation Development Business of the Small and Medium Business Administration	High Purity Oxygen Free High Conductivity Copper Development for Magnetron Material	May 2001 – April 2002	Finished
5	International Collaboration Cooperation Business	Development of Copper Alloy with High Elasticity and Excellent Wear Resistance under High Temperature	Nov. 2001 – Oct. 2002	Finished
6	Ground Industrial Technology Development Business	Development of Alloy Design and Manufacturing Technology of Connector Material with High Electrical Conductivity and Strength	July 2002 – June 2005	Finished
7	Technology Innovation Development Business of the Small and Medium Business Administration	Development of High Temperature Wear Resistance Material and Process Technology for Welding Contact Tip	July 2005 – June 2006	Finished
8	Ground Industrial Technology Development Business	Development of New Manufacturing Technology of Copper and Copper Alloy Multi-gauge Strip for Electronic Industry	June 2006 – May 2008	In Progress





## ● Brief History



- May 1968 established Wonil company : Zinc plates for printing
- March 1979 constructed and moved to a new factory in Bucheon, Kyunggi-Do
- May 1984 selected as a promising small and medium-sized business by the Ministry of Science and Technology
- July 1986 incorporated as Wonil Co., Ltd.
- March 1988 constructed and moved to a new factory in Ansan, Kyunggi-Do
- July 1990 constructed the head office in Seoul
- July 1993 acquired the Korean Industrial Standards Mark(KS D 5201)
- October 2000 succeeded in the development and initiated the mass production of the oxygen free high conductivity copper
- May 2001 acquired the certification of ISO 9001 : 2000 Quality Management System
- July 2001 awarded the Minister's Prize from the Ministry of Commerce, Industry and Energy in New Tech Korea 2001 : Manufacturing technology of the oxygen free with silver copper for the ultra-high speed commutator
- January 2002 established Sewon Advanced Metals Co., Ltd. in Ansan, Kyunggi-Do : Special business of the advanced copper alloys
- April 2003 established a research institute
- August 2003 acquired the certification of Venture Business in New Technology Business Section
- October 2003 established Lotus Building Materials Co., Ltd. in Daegu : Special business of the building materials
- September 2004 awarded the Promotion Prize from the 5th Innovation Technology Fair : Manufacturing technology of the high grade oxygen free high conductivity copper and with silver copper by deoxidation refinement technology
- April 2005 established Wonil Building Materials Co., Ltd. in Shanghai
- November 2005 acquired the Korean Industrial Standards Mark of Sewon Advanced Metals Co., Ltd.(KS D 5506)
- December 2005 acquired the certification of technology innovational small and medium-sized business(INNO-BIZ)
- May 2006 acquired the certification of ISO 14001 : 2004 Environmental Management System
- May 2006 acquired the certification of ISO 9001 : 2000 Quality Management System of Sewon Advanced Metals Co., Ltd.
- May 2006 acquired the certification of ISO 14001 : 2004 Environmental Management System of Sewon Advanced Metals Co., Ltd.

