

ThyssenKrupp Materials NA, Inc.
MATERIAL SAFETY DATA SHEET
COPPER/COPPER ALLOYS

SECTION I. MATERIAL IDENTIFICATION

COMPANY ThyssenKrupp Materials NA, Inc. 22355 West Eleven Mile Road Southfield, Michigan 48033	RE-ISSUE DATE 5-Dec-08	IDENTIFICATION NUMBER N/A
TRADE NAME Copper/Copper Alloys	EMERGENCY PHONE NUMBER (248) 233-5681	PREPARED BY: J. VanValkenburg
CHEMICAL NAME Copper	FORMULA DOT N/A	IDENTIFICATION NO. N/A

SECTION II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	CAS NUMBER	PHYSICAL Description	OSHA-PEL 8-HR. - TWA	ACGIH-TLV 8-HR TWA (1988-89)	ACGIH STEL (1988-89)
Aluminum	(7429-90-5)	(Dust) (Fume)	15 mg/m3 5 mg/m3	10 mg/m3 5 mg/m3	
Antimony	(7440-38-0)		0.5 mg/m3	0.5 mg/m3	
Arsenic	(7440-38-2)		0.5 mg/m3	0.02 mg/m3	
Beryllium	(7440-41-7)		0.002 mg/m3	0.002 mg/m3	0.005*
Bismuth telluride	(1304-82-1)	(Dust)	15 mg/m3	15 mg/m3	
Boron oxide	(1303-86-2)	(Dust)	15 mg/m3	10 mg/m3	
Cadmium	(7440-43-9)	(Dust) (Fume)	0.2 mg/m3 0.05 mg/m3	0.05 mg/m3 0.05 mg/m3*	
Calcium oxide	(1305-78-8)		5 mg/m3	5 mg/m3	
Carbon black	(1333-86-4)		3.5 mg/m3	—	
Chromium	(7440-47-3)		1 mg/m3	0.5 mg/m3	
Cobalt	(7440-48-4)		0.05 mg/m3	0.1 mg/m3	
Copper	(7440-50-8)	(Dust) (Fume)	1 mg/m3 0.1 mg/m3	1 mg/m3 0.2 mg/m3	
Iron	(1309-37-1)		10 mg/m3	5 mg/m3 (As iron oxide fume)	
Lead ³	(7439-92-1)		0.05 mg/m3	0.15 mg/m3	
Lithium hydride	(7580-67-8)		0.025 mg/m3	0.025 mg/m3	
Manganese	(7439-96-5)	(Dust) (Fume)	5 mg/m3 —	5 mg/m3 1 mg/m3	3 mg/m3
Magnesium oxide	(1309-48-4)	(Dust)	15 mg/m3	10 mg/m3	
Nickel	(7440-02-0)		1 mg/m3	1.5 mg/m3	
Phosphorus	(7723-14-0)		0.1 mg/m3	0.1 mg/m3	
Selenium	(7782-49-2)		0.2 mg/m3	0.2 mg/m3	
Silicon	(7440-21-3)	(Dust) (Fume)	10 mg/m3 5 mg/m3	10 mg/m3A —	
Silver	(7440-22-4)		0.01 mg/m3	0.1 mg/m3	
Sulphur Dioxide	(7446-09-5)		13 mg/m3	5 mg/m3	5/10 mg/m3
Tellurium	(13494-80-9)		0.1 mg/m3	0.1 mg/m3	
Tin ²	(7440-31-5)		2 mg/m3	2 mg/m3	0.2 mg/m3 (contemplated)
Titanium dioxide	(13463-67-7)	(Dust)	15 mg/m3	10 mg/m3	
Zinc	(1314-13-2)	(Dust) ¹ (Fume)	10 mg/m3 5 mg/m3	10 mg/m3 5 mg/m3	10 mg/m3
Zirconium	(7440-67-7)		5 mg/m3	5 mg/m3	10 mg/m3

*Ceiling Limit

Note: antimony trioxide, beryllium, cadmium, chromium, cobalt-chromium alloy, lead and nickel have been identified as potential human carcinogens. # denotes a toxic chemical or chemicals subject to reporting requirements of Section 313 of Title III of the S.A.R.A. of 1986 and CFR Part 372.

¹ Value is for total dust containing no asbestos and less than 1% free silicon.

² Contemplated change to 0.2 STEL and 0.1 TWA.

³ Under court remand.

PEL=Permissible Exposure Limit

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SECTION III. PHYSICAL DATA

MATERIAL (At Normal Conditions)	APPEARANCE AND ODOR
SOLID	Silver or Yellow to Red; No Odor
MELTING POINT	SPECIFIC GRAVITY
1290° - 2260°F	7.45 - 9.00

SECTION IV. FIRE AND EXPLOSIVE

Flash Point: (Method Used) Not Applicable	Extinguishing Media: See Below
Flammable Limits (LEL-UEL) Not Applicable	Auto Ignition Temp.-Not Applicable
<p>Special Fire Fighting Procedures: Solid massive form is not combustible. Fire and explosion hazards. are moderate when material is in the form of dust and exposed to heat, flames, chemical reaction, or in contact with powerful oxidizers. Use special mixtures of dry chemical or sand. Firefighters should wear NIOSH/MSHA self-contained breathing apparatus and protective clothing.</p> <p>Molten metal may react violently with water.</p> <p>NFPA & HMIS Rating - Flammability: 0 Reactivity: 2 Health: 0 Special Hazards: 0</p>	

SECTION V. REACTIVITY DATA

STABILITY	CONDITIONS TO AVOID	
Stable	Stable under normal conditions of transport and storage. Molten metal may react violently with water.	
HAZARDOUS DECOMPOSITION PRODUCTS	Incompatibility (Materials to Avoid):	Hazardous Polymerization:
Metal fume.	Acids, bases, and oxidizers.	Will not occur.

SECTION VI. HEALTH HAZARD DATA

Permissible exposure limits and threshold limit values. See Section II.

Routes of Entry: Inhalation: Yes; Skin: Yes; Ingestion: Yes

Under normal handling conditions the solid alloy presents no significant health hazards. Processing of the alloy by dust or fume producing operation (grinding, buffing, heating, welding, etc.) may result in the potential for exposure to airborne metal particulates or fume. The exposure levels in Section II are relevant to fumes and dusts.

EFFECTS OF OVEREXPOSURE:

Acute -	Dust or fume may cause irritation to the eyes, nose, or throat and may leave a metallic taste in the mouth. Inhalation of oxides of Manganese, or Copper may be manifested as flu-like symptoms commonly known as "metal fume fever". Phosphorous dust is considered a nuisance dust.
Chronic -	
Aluminum:	Inhalation of Aluminum Oxide fume or an accumulation of Silicon in the lungs may result in benign pneumoconiosis.
Antimony:	Antimony and its compounds are irritating to the skin and mucous membranes and are systemic poisons.
Beryllium:	Inhalation of beryllium dust or fume may cause chronic beryllium disease (CBD) and is a cancer hazard.
Cadmium:	Inhalation of cadmium fumes may cause respiratory irritation with a sore, dry throat and a metallic taste followed by a cough, chest pain, and difficulty in breathing. The liver, kidneys and bone marrow may be injured by the presence of the metal.
Cobalt:	Lung inflammation and damage, and diffuse pulmonary fibrosis from inhalation. Classified as a carcinogen by IARC.
Chromium:	May enter and affect the body through Inhalation, Ingestion, or skin contact. The National Toxicology Program (NTP) and the Internal Agency for Research on Cancer (IARC) report they possess sufficient evidence to establish a causal relationship for human cancer from Chromium.
Copper:	Inhalation may cause nose and throat irritation and metal fume fever and prolonged contact may cause dermatitis, discoloration of skin, hair and teeth.
Iron:	Inhalation of Iron Oxide fume or dust may result in a condition known as siderosis.
Lead:	Lead compounds can be toxic when ingested or inhaled. Lead is a cumulative poison and excessive exposure can have an adverse effect on human reproduction. Acute exposure to lead can be manifested as abdominal pain, nausea, constipation, anorexia, or vomiting, and in severe cases death.
Manganese:	Inhalation may result in symptoms such as headache, restlessness, neurological dysfunction, or muscular weakness.
Nickel:	Inhalation may result in inflammation of the respiratory tract and fever. The National Toxicology Program (NTP) and the International Agency for Research on Cancer (IARC) report they possess limited evidence for human cancer from Nickel and Nickel compounds.
Silicon:	An accumulation of Silicon in the lungs may result in benign pneumoconiosis.
Tin:	May cause eye, skin, and respiratory system irritation.
Zinc:	Dust or fume may cause irritation to the eyes, nose, or throat and may leave a metallic taste in the mouth. Inhalation of oxides may cause "metal fume fever"
Coatings:	If coated with oil, contact may cause skin irritation/dermatitis.
Welding Fume:	Is listed as a possible carcinogen to humans.
NOTE:	Antimony trioxide, beryllium, cadmium, chromium, cobalt-chromium alloy, lead and nickel have been identified as potential human carcinogens.

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SECTION VII. EMERGENCY AND FIRST AID PROCEDURES

Inhalation:	In the event of excessive exposure to dust or fume, remove the employee to fresh air. If breathing is difficult administer artificial respiration or oxygen. Obtain immediate medical assistance.
Skin:	Abrasions and cuts should be washed and closed by a clean compress and be immediately medically treated. Should skin irritation occur, wash affected area with mild soap and rinse with clean warm water. Obtain medical assistance.
Eyes:	Depending on the type and nature of exposure, relief may be obtained by fresh air or rinsing the eyes with clean water. Obtain medical assistance.
Medical Conditions Aggravated by Exposure:	Persons with a predisposition to respiratory disorders may be adversely affected by particulates or respiratory irritants generated during the mfg. process.

SECTION VIII. SPECIAL PROTECTION INFORMATION & CONTROL MEASURES

Note:	Consult your regional codes or Code of Federal Regulations, Title 29, Part 1910. Subpart G-Occupational Health and Environmental Control, Subpart I Personal Protective Equipment. Subpart P-Welding, Cutting, and Brazing, and Subpart Z-Toxic and Hazardous Substances. Certain welding type activities may produce hazardous substances such as carbon monoxide, ozone, phosgene in the presence of certain chemicals, or produce inert suffocating atmospheres in addition to the production of ultraviolet radiation and/or noise.
Ventilation:	Additional air make up systems may be required if, local exhaust or ventilation systems are not sufficient to maintain exposure levels to contaminants below prescribed limits. When inhalation controls are not sufficient to reduce the exposure below the applicable exposure limit then use OSHA/NIOSH approved respiratory protection within the use limitations of the respirator.
Personal Protection:	To avoid contact use appropriate protective gloves or clothing to protect against cutting edges Appropriate heat shielding garments should be used for activities using or generating heat. Eyes should be protected by using safety glasses, goggles, helmet, face shield as appropriate to the operation.
Precautions to be taken in handling and storage:	Be alert to sharp edges and unsecured Lifts.

SECTION IX. OTHER INFORMATION

SARA Section 313 Toxic Chemical List, de minimis Concentrations	
> 1.0%: Copper, Aluminum, Zinc, and Manganese	TSCA Status All components are listed on the TSCA inventory
> 0.1%: Chromium, Cobalt, Lead, and Nickel	CERCLA Hazardous Substances Chromium, Lead, Copper & Zinc
California Proposition 65	
The state of California lists chromium (Hexavalent compounds), nickel, lead, and cobalt as chemicals known to cause cancer and reproductive toxicity.	
Cadmium, cadmium compounds, and lead may be present as impurities of the manufacturing process.	
Chromium (Hexavalent compounds) may be generated during certain manufacturing processes.	

LIABILITY DISCLAIMER

The Information contained in this Material Safety Data Sheet (MSDS) is believed to be correct as it was obtained from sources which we believe are reliable, including "Threshold Limit Values & Biological Exposure Indices for 1988-1989" (American Conference of Government & Industrial Hygienists), Air Contaminates-Permissible Exposure Limits (Title 29 Code of Federal Regulations, part 1910.1000-OSHA (Cleveland Area Office) letter of 6/15/89. However, no representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications, hazards connected with the use of the material, or the results to be obtained from the use thereof. User assumes all risk and liability of any use, processing the material and handling of any material, variations in methods, conditions and equipment used to store, handle or process the material and hazards connected with the use of the material are solely the responsibility of the user and remain at his sole discretion.

Compliance with all applicable federal, state, and local laws and regulations remains the responsibility of the user, and the user has the responsibility to provide a safe workplace, to examine all aspects of its operation and to determine if or where precautions, in addition to those described herein, are required.

Note: The copper and copper alloy products are in solid form and will not result in an environmental exposure in such form. We cannot anticipate all the processes or applications to which this product might be subjected or which create exposures. The information supplied has been furnished by our suppliers and consequently, our company assumes no responsibility for the accuracy or completeness of the data contained herein.

Copper Alloy (Nominal) Composition Sheet

ThyssenKrupp Materials NA, Inc.
22355 West Eleven Mile Road
Southfield, Michigan 48034
(248) 233-5681

Re-issued December 5, 2008

Copper Alloy	UNS No.	Name	Copper %	Zinc %	Lead %	Nickel %	Tin %	Phosphorus %	Ar-senic %	Tellurium %	Chromium %	Cadmium %	Sulfur %	Zirconium %	Silicon %	Silver %	Beryllium %	Iron %	Manganese %	Aluminum %	Cobalt %	Misc. %
C10100		Oxygen Free Electronic Copper	99.99+	-	-	-	-	-	-	.0010	-	-	-	-	-	-	-	-	-	-	-	-
C10200		OF Copper	99.95+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C10300		Oxygen Free Extra Low Phosphorus	99.95+	-	-	-	-	.001-.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C10400		Silver Bearing OFHC Copper	99.95	-	-	-	-	0.003	-	-	-	-	-	-	-	.027	-	-	-	-	-	-
C10700		Silver Bearing OFHC Copper	99.95	-	-	-	-	-	-	-	-	-	-	-	-	.085	-	-	-	-	-	-
C10800		Oxygen Free Low Phosphorus	99.95+	-	-	-	-	.005-.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C11000		Electrolytic Tough Pitch Copper	99.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C11020		FRHC	99.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C11300		Silver Bearing Copper	99.90	-	-	-	-	-	-	-	-	-	-	-	-	.027	-	-	-	-	-	-
C11400		Silver Bearing Copper	99.90	-	-	-	-	-	-	-	-	-	-	-	-	.034	-	-	-	-	-	-
C11500		Silver Bearing Copper	99.90	-	-	-	-	-	-	-	-	-	-	-	-	.054	-	-	-	-	-	-
C11600		Silver Bearing Copper	99.90	-	-	-	-	-	-	-	-	-	-	-	-	.085	-	-	-	-	-	-
C12000		Phosphorized Copper DLP	99.90	-	-	-	-	.004-.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C12100		Phosphorized Copper DLP	99.90	-	-	-	-	.005-.012	-	-	-	-	-	-	-	0.014	-	-	-	-	-	-
C12200		Phosphorized Copper	99.98	-	-	-	-	.015-.040	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C12900		FRSTP	99.88	-	0.004	0.05	-	-	0.012	0.03	-	-	-	-	-	-	-	-	-	-	-	.003 Bi
C14200		Arsenical Copper DPA	99.40	-	-	-	-	.015-.040	.15-.50	-	-	-	-	-	-	-	-	-	-	-	-	-
C14420		Cadmium Copper Deoxidized	99.90	-	-	-	-	.013-.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C14500		Tellurium Copper	99.90	-	-	-	-	.004-.012	.40-.7	-	-	-	-	-	-	-	-	-	-	-	-	-
C14520		DPTe	99.40	-	-	-	-	.004-.020	.40-.7	-	-	-	-	-	-	-	-	-	-	-	-	-
C14530		DPTe	99.40	-	-	-	-	.004-.020	.40-.7	-	-	-	-	-	-	-	-	-	-	-	-	-
C14700		OFHC Sulfur copper	99.90	-	-	-	-	-	-	-	-	-	0.30	-	-	-	-	-	-	-	-	-
C15000		Anzirc(Zirconium Cu)AMPCO 910 EXTR	99.80	-	-	-	-	-	-	-	-	-	-	0.17	-	-	-	-	-	-	-	-
C15500		DPTe	99.75	-	-	-	-	.040-.080	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C16200		Cadmium Copper	99.00	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	0.02	-	-	-	-
C16500		Cadmium Copper	98.58	-	-	-	.5-.7	-	-	-	-	0.80	-	-	-	-	-	-	-	-	-	-
C17000		Beryllium Copper*	98.30	-	-	-	-	-	-	-	-	-	-	-	-	-	1.60-1.79	-	-	0.2	-	-
C17200		Beryllium Copper*	98.10	-	-	-	-	-	-	-	-	-	-	-	-	-	1.80-2.00	-	-	0.2	-	-
C17300		Beryllium Copper*	97.70	-	-	-	-	-	-	-	-	-	-	-	-	-	1.80-2.00	-	-	0.2	-	-
C17410		Beryllium Copper	99.50	-	-	-	-	-	-	-	-	-	-	-	-	0.2	.15-.50	0.2	-	0.2	-	-
C17500		Beryllium Copper	96.90	-	-	-	-	-	-	-	-	-	-	-	-	-	.40-.7	0.1	-	0.2	2.4-2.7	-
C17510		Beryllium Copper	97.50	-	-	1.4-2.2	-	-	-	-	-	-	-	-	-	-	.20-.6	0.1	-	0.2	-	-
C18000		NI Chromium Cop. AMPCO 940 EXTR.	96.40	-	-	2.0-3.0	-	-	-	-	.10-.6	-	-	-	-	-	-	0.15	-	-	-	-
C18135		High Copper Alloy	99.40	-	-	-	-	-	-	-	.20-.6	2-.6	-	-	-	-	-	-	-	-	-	-
C18140		High Copper Alloy	99.60	-	-	-	-	-	-	-	.15-.45	-	-	-	-	-	-	-	-	-	-	-
C18150		High Copper AMPCO 972 EXTR.	98.70	-	-	-	-	-	-	-	.50-1.5	-	-	-	-	-	-	-	-	-	-	-
C18200		Chromium Copper AMPCO 97 EXTR.	99.14	-	0.05	-	-	-	-	-	.6-1.2	-	-	-	-	-	-	-	0.1	-	-	-
C18700		Leaded Copper	99.00	-	.8-1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19100		Chromium Copper	98.50	0.5	0.10	.9-1.3	-	-	-	-	.35-.6	-	-	-	-	-	-	-	-	.10	-	-

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Re-issued December 5, 2008

Copper Alloy UNS No.	Name	Copper %	Zinc %	Lead %	Nickel %	Tin %	Phos- phorus %	Ar- senic %	Tellur- ium %	Chro- mium %	Cad- mium %	Sul- fur %	Zirco- nium %	Sili- con %	Silver %	Beryll- ium %	Iron %	Man- ganese %	Alumi- num %	Cobalt %	Misc. %
C19150	High Copper Alloy	97.80	-	50-1.0	8-1.2	0.05	15-35	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C19400	High Copper Alloy	97.0 min	.05-.20	0.03	-	-	.015-.15	-	-	-	-	-	-	-	-	-	2.1-2.6	-	-	-	-
C19500	High Copper Alloy	96.00	0.2	0.02	-	.10-1.0	.01-.35	-	-	-	-	-	-	-	-	-	1.0-2.0	-	0.02	.3-1.3	-
C19700	High Copper Alloy	98.40	0.2	0.05	0.05	0.2	.10-.40	-	-	-	-	-	-	-	-	-	.30-1.2	0.05	-	0.05	.01-.2 Mg
C19900	High Copper Alloy	96.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9-3.4 Ti
C21000	Gilding	94.0-96.0	5.00	0.03	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C22000	Commercial Bronze	89.0-91.0	10.00	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C22600	Jewelry Bronze	86.0-89.0	12.50	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C23000	Red Brass	84.0-86.0	15.00	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C24000	Low Brass	78.5-81.5	20.00	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C26000	Cartridge Bras	68-71.5	30.00	0.07	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C26800	Yellow Brass	64.0-68.5	34.00	0.015	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C27000	Yellow Brass	63.0-68.5	35.00	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-
C27200	Yellow Brass	62.0-65.0	37.00	0.07	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-
C27400	Yellow Brass	61.0-64.0	38.00	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C28000	Muntz Metal	59.0-63.0	40.00	0.3	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-
C31400	Leaded Commercial Bronze	87.5-90.5	9.10	1.3-2.5	0.7	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C31600	High strength Commercial Bronze	87.5-90.5	7.65	1.3-2.5	1.0	-	0.10	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C32000	Hardware Bronze	83.5-86.5	13.25	1.5-2.2	0.25	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C33000	Low Leaded Tube Brass	65.0-68.0	33.00	.25-.7	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-
C33100	Leaded Tube Brass	65.0-68.0	33.00	.8-1.5	-	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-
C33200	Free Cutting Tube Brass	65.0-68.0	31.90	1.5-2.5	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-
C33500	Low Leaded Brass	62.0-65.0	34.50	.25-.7	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C34000	Medium Leaded Brass	62.0-65.0	34.00	.8-1.5	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C34200	High Leaded Brass	62.0-65.0	34.00	1.5-2.5	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C34500	High Leaded Brass	62.0-65.0	35.25	1.5-2.5	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C35000	Medium Leaded Brass	60.0-63.0	36.90	.8-2.0	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C35300	High Leaded Brass	60.0-63.0	36.70	1.5-2.5	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C35600	Extra High Leaded Brass	60.0-63.0	35.00	2.0-3.0	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C36000	Free Cutting Brass	60.0-63.0	35.25	2.5-3.7	-	-	-	-	-	-	-	-	-	-	-	-	0.35	-	-	-	-
C36500	Leaded Muntz Metal	58.0-61.0	39.35	.25-.7	-	0.25	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C37000	Free Cutting Muntz Metal	59.0-62.0	39.00	.8-1.5	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
C37700	Forging Brass	58.0-61.0	38.00	1.5-2.5	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-
C38000	Architectural Bronze Low Leaded	55.0-60.0	-	1.5-2.5	-	0.3	-	-	-	-	-	-	-	-	-	-	0.35	-	0.5	-	-
C38500	Architectural Bronze	55.0-59.0	40.00	2.5-3.5	-	-	-	-	-	-	-	-	-	-	-	-	0.35	-	-	-	-
C40400	Architectural Bronze	97.00	2.0-3.0	-	-	.35-.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C40500	Architectural Bronze	94.0-96.0	-	0.05	-	.7-1.3	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C41100	Bearing Bronze	89.0-92.0	9.50	0.1	-	.30-.7	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C42500	Contact Bronze	87.0-90.0	9.30	0.05	-	1.5-3.0	0.35	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-

Copper Alloy (Nominal) Composition Sheet

ThyssenKrupp Materials NA, Inc.
22355 West Eleven Mile Road
Southfield, Michigan 48034
(248) 233-5681

Re-issued December 5, 2008

Copper Alloy	UNS No.	Name	Copper %	Zinc %	Lead %	Nickel %	Tin %	Phosphorus %	Arsenic %	Tellurium %	Chromium %	Cadmium %	Sulfur %	Zirconium %	Silicon %	Silver %	Beryllium %	Iron %	Manganese %	Aluminum %	Cobalt %	Misc. %
C43500	Trumpet Metal	79.0-83.0	18.10	0.1	-	-	.6-1.2	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
C44300	Arsenical Admiralty	70.0-73.0	27.96	0.07	-	-	.8-1.2	-	0.04	-	-	-	-	-	-	-	-	0.06	-	-	-	-
C44400	Antimonial Admiralty	70.0-73.0	28.00	0.07	-	-	.8-1.2	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-
C44500	Phosphorized Admiralty	70.0-73.0	27.96	0.07	-	-	.8-1.2	.02-.10	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-
C46200	Naval Brass	62.0-65.0	35.75	0.2	-	-	.50-1.0	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C46400	Naval Brass	59.0-62.0	39.25	0.2	-	-	.50-1.0	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C46500	Arsenical Naval Brass	59.0-62.0	39.70	0.2	-	-	.50-1.0	-	0.04	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C48200	Leaded Naval Brass	59.0-62.0	38.55	.40-1.0	-	-	.50-1.0	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C48500	Leaded Naval Brass	59.0-62.0	37.50	1.3-2.2	-	-	.50-1.0	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C50500	Phosphor Bronze (E)	98.70	0.3	0.05	-	-	1.0-1.7	.03-.35	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C51000	Phosphor Bronze (A)	94.80	0.3	0.05	-	-	4.2-5.8	.03-.35	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C51100	Phosphor Bronze	95.60	0.3	0.05	-	-	3.5-4.9	.03-.35	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C52100	Phosphor Bronze (C)	91.75	0.2	0.05	-	-	7.0-9.0	.03-.35	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C52400	Phosphor Bronze (D)	89.75	0.2	0.05	-	-	9-11	.03-.35	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C53400	Phosphor Bronze (B-1)	93.90	-	.8-1.2	-	-	3.5-5.8	.03-.35	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C54400	Phosphor Bronze (B-2)	87.90	1.5-4.5	3.5-4.5	-	-	3.5-4.5	.01-.50	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
C61000	Aluminum Bronze	92.00	0.2	0.02	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.05	-	6.0-8.5	-	-
C61300	Aluminum Bronze	90.00	0.1	0.01	0.15	20-50	0.015	-	-	-	-	-	-	-	0.1	-	-	2.0-3.0	-	6.0-7.5	-	-
C61400	Aluminum Bronze (D) AMPCO 8	90.25	0.2	0.01	-	-	-	0.015	-	-	-	-	-	-	-	-	-	1.5-3.5	1.0	6.0-8.0	-	-
C62300	Aluminum Bronze AMPCO 15	85.70	-	-	1.0	0.6	-	-	-	-	-	-	-	-	0.25	-	-	2.0-4.0	0.5	8.5-10.0	-	-
C62400	Aluminum Bronze AMPCO 18 EXTR.	85.50	-	-	-	0.2	-	-	-	-	-	-	-	-	0.25	-	-	2.0-4.5	0.3	10.0-11.5	-	-
C62500	Aluminum Bronze	80.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.5-5.5	2.0	12.5-13.5	-	-
C63000	Aluminum Nickel Bronze AMPCO 45	82.00	0.3	-	4.0-5.5	0.2	-	-	-	-	-	-	-	-	0.25	-	-	2.0-4.0	1.5	9.0-11.0	-	-
C64200	Aluminum Bronze	90.75	0.5	0.05	0.25	0.2	-	-	-	-	-	-	-	-	1.5-2.2	-	-	0.3	.10	6.3-7.6	-	-
C65100	Low Silicon Bronze (B)	98.25	1.5	0.05	-	-	-	-	-	-	-	-	-	-	.8-2.0	-	-	0.8	0.7	-	-	-
C65500	High Silicon Bronze (A)	95.80	1.5	0.05	0.6	-	-	-	-	-	-	-	-	-	2.8-3.8	-	-	0.8	5-1.3	-	-	-
C66100	High Silicon Bronze A	94.00	1.5	.20-.8	-	-	-	-	-	-	-	-	-	-	2.8-3.5	-	-	0.25	1.5	-	-	-
C66700	Manganese Brass	68.5-71.5	28.80	0.07	-	-	-	-	-	-	-	-	-	-	.8-1.5	-	-	0.1	.8-1.5	-	-	-
C66800	Manganese Brass	60.0-63.0	-	0.5	0.25	0.3	-	-	-	-	-	-	-	-	.50-1.5	-	-	0.35	2.0-3.5	0.25	.25-.55	-
C67300	Manganese Bronze (B)	58.0-63.0	-	.40-3.0	0.25	0.3	-	-	-	-	-	-	-	-	.50-1.5	-	-	0.5	2.0-3.5	0.25	-	-
C67400	Manganese Bronze (B)	57.0-60.0	-	0.5	0.25	0.3	-	-	-	-	-	-	-	-	.50-1.5	-	-	0.35	2.0-3.5	.50-2.0	-	-
C68100	Bronze, Low Fuming	56.0-60.0	-	0.05	-	-	.75-1.10	-	-	-	-	-	-	-	.04-.15	-	-	.25-1.25	.01-.50	0.01	-	-
C68700	Aluminum Brass-Arsenical	76.0-79.0	20.46	0.07	-	-	-	-	0.04	-	-	-	-	-	-	-	-	0.06	-	1.8-2.5	-	-
C69400	Silicon Red Brass	80.0-83.0	14.50	0.3	-	-	-	-	-	-	-	-	-	-	3.5-4.5	-	-	0.2	-	-	-	-
C70200	Silicon Red Brass	97.00	-	0.05	2.0-3.0	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.1	-	-	-
C70600	Cupro Nickel, 10%	88.35	1.0	0.05	9.0-11.0	-	-	-	-	-	-	-	-	-	-	-	-	1.0-1.8	1.0	-	-	-
C71000	Cupro Nickel, 20%	78.75	1.0	0.05	19.0-23.0	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-	-	-
C71500	Cupro Nickel, 30%	68.90	1.0	0.05	29.0-33.0	-	-	-	-	-	-	-	-	-	-	-	-	.40-1.0	1.0	-	-	-
C71581	Copper-Nickel, 30%	28.00	-	0.02	29.0-32.0	-	-	-	-	-	-	-	-	-	-	-	-	.40-7	1.0	-	-	-

Copper Alloy (Nominal) Composition Sheet

ThyssenKrupp Materials NA, Inc.
22355 West Eleven Mile Road
Southfield, Michigan 48034
(248) 233-5681

Re-issued December 5, 2008

Copper Alloy	UNS No.	Name	Copper %	Zinc %	Lead %	Nickel %	Tin %	Phos-phorus %	Ar-senic %	Tellur-ium %	Chro-mium %	Cad-mium %	Sul-fur %	Zirco-nium %	Sili-con %	Silver %	Beryll-ium %	Iron %	Man-ganese %	Alumi-num %	Cobalt %	Misc. %
C72500		Curpo Nickel, 9%	88.20	0.5	0.05	8.5-10.5	1.8-2.8	-	-	-	-	-	-	-	-	-	-	0.6	.20	-	-	-
C73500		Copper-Nickel, 30%	70.5-73.5	-	0.25	16.05-19.5	-	-	-	-	-	-	-	-	-	-	-	0.25	0.5	-	-	-
C74000		Copper-Nickel, 30%	69.0-73.5	-	0.1	9.0-11.0	-	-	-	-	-	-	-	-	-	-	-	0.25	0.5	-	-	-
C74500		Nickel Silver, 10%	63.5-66.5	24.75	0.1	9.0-11.0	-	-	-	-	-	-	-	-	-	-	-	0.25	.50	-	-	-
C75200		Nickel Silver, 18%	63.5-66.5	17.25	0.05	16.5-19.5	-	-	-	-	-	-	-	-	-	-	-	0.25	.50	-	-	-
C75700		Nickel Silver, 12%	63.5-66.5	22.75	0.05	11.0-13.0	-	-	-	-	-	-	-	-	-	-	-	0.25	.50	-	-	-
C76200		Nickel Silver, 12%	57.0-61.0	28.75	0.1	11.0-13.5	-	-	-	-	-	-	-	-	-	-	-	0.25	.50	-	-	-
C77000		Nickel Silver, 18%	53.5-56.5	26.75	0.05	16.5-19.5	-	-	-	-	-	-	-	-	-	-	-	0.25	.50	-	-	-
C77300		Nickel Silver	46.0-50.0	41.00	0.05	9.0-11.0	-	0.25	-	-	-	-	-	-	.04-.25	-	-	-	-	0.01	-	-
C78200		Leaded Nickel Silver	63.0-67.0	25.00	1.5-2.5	7.0-9.0	-	-	-	-	-	-	-	-	-	-	-	0.35	.50	-	-	-
C79200		Leaded Nickel Silver, 12%	59.0-66.5	25.50	.8-1.4	11.0-13.0	-	-	-	-	-	-	-	-	-	-	-	0.25	.50	-	-	-
C79600		Leaded Nickel Silver, 10%	45.00	42.00	1.00	10.00	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-
C79800		Nickel Silver	45.5-48.5	-	1.5-2.5	9.0-11.0	-	-	-	-	-	-	-	-	-	-	-	0.25	1.5-2.5	-	-	-
C86300		Manganese Bronze Leaded MB (Alloy)	60.0-66.0	22.0-28.0	0.20	1.0	0.2	-	-	-	-	-	-	-	-	-	-	2.0-4.0	2.5-5.0	5.0-7.5	-	-
C90500		Copper Tin Alloys	86.0-88.0	1.0-3.0	0.30	1.0	9.0-11.0	-	-	-	-	-	-	0.05	0.005	-	-	0.2	-	0.005	-	-
C92200		Copper Tin Lead Alloys	86.0-90.0	3.0-5.0	1.0-2.0	1.0	5.5-6.5	-	-	-	-	-	0.05	0.05	0.005	-	-	0.25	-	0.005	-	-
C92500		Copper Tin Lead Alloys	85.0-88.0	0.50	1.0-1.5	.8-1.5	10.0-12.0	-	-	-	-	-	0.05	0.05	0.005	-	-	0.3	-	0.005	-	-
C93200		Bearing Bronze	81.0-85.0	1.0-4.0	6.0-8.0	1.0	6.3-7.5	0.15	-	-	-	-	0.08	0.08	0.005	-	-	0.20	-	.005	-	.35 Sb
C94000		Lead Tin Bronze	69.0-72.0	0.50	14.0-16.0	.5-1.0	13.00	0.05	-	-	-	-	0.08	0.08	0.005	-	-	0.25	0	0.005	-	.50 Sb
C95200		Aluminum Bronze	86.0 min	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5-9.5	-	-
C95400		Aluminum Bronze AMPCO 18 Cast	83.50	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	3.0-5.0	.50	10.0-11.5	-	-
C95510		Aluminum Bronze	78.0 min	0.3	-	4.5-5.5	0.2	-	-	-	-	-	-	-	-	-	-	2.0-3.5	1.5	9.0-10.9	-	-
C95900		Aluminum Bronze	81.00	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	3.0-5.0	1.5	12.0-13.5	-	-
C97300		Copper Nickel Zinc Alloys	53.0-58.0	17.0-25.0	8.0-11.0	11.0-14.0	1.5-3.0	0.05	-	-	-	-	-	0.08	0.15	-	-	1.5	0.5	0.005	-	-

* Ni+Co, .20% min.; Ni + Fe + Co, .6% max.

MATERIAL SAFETY DATA SHEET

BERYLLIUM COPPER SUPPLEMENT

ThyssenKrupp Materials NA, Inc.
22355 West Eleven Mile Road
Southfield, Michigan 48034
Phone (248) 233-5681 or Fax (248) 233-5755

Re-issue Date 12-5-2008

J. VanValkenburg

Material: Beryllium Copper

Potential Health Effects from Exposure to Beryllium Copper Alloy

Copper beryllium (CuBe), in solid form and as contained in finished products, present no specific health risks. Most manufacturing operations conducted properly on well-maintained equipment are capable of safely processing copper beryllium containing materials. However, like many industrial materials, copper beryllium may present a health risk if handled improperly. The degree of hazard varies depending on the form of the product, how it is processed and handled, as well as the amount of beryllium in the product. The inhalation of copper beryllium dusts, fumes, or mists can cause a serious lung condition in some individuals. The primary hazard associated with copper beryllium involves processes that generate small airborne dusts, fumes, and mists having diameters less than 10 microns or 0.0005 inch, at which size they are invisible to the naked eye. Many processes do not generate particles this small; using appropriate engineering and work practice controls must control those that do. You must read the product specific Material Safety Data Sheet (MSDS) for additional environmental, health, and safety information before working with any beryllium containing material.

Routes of Entry

Beryllium can enter the body in three ways: eye or skin contact, ingestion or swallowing, and most concern, inhalation or breathing. No special health risks are associated with eye contact, skin contact or ingestion of copper beryllium alloys.

Eye Contact - As with any metal processing operation, injury can result from particulate irritation or mechanical injury to the eyes from contact with metallic dust, chips, or particles. Use proper protection such as safety glasses with side shields, goggles, or face shields to prevent eye injury.

Skin Contact - No special health risk is associated with skin contact with copper beryllium materials. A cut or laceration received from a sharp edge of copper beryllium material is no different from cuts received by other metals and routine first aid treatment is appropriate. Some individuals may be sensitive to copper in these products as a result of long-term contact.

Ingestion - There are no known cases of illness resulting from ingestion of copper beryllium containing materials; however, the potential for irritation exists. Copper beryllium, as with most industrial materials, is not intended for internal human consumption. Ingestion can occur when metal dust, fume, or powder contacts hands, clothing, food, and drinks and this followed by eating, drinking, smoking, nail biting, etc. Always practice good personal hygiene by not eating, drinking, or smoking in manufacturing areas and wash hands before doing so in designated areas.

**MATERIAL SAFETY DATA SHEET
BERYLLIUM COPPER SUPPLEMENT
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Re-Issue Date 12-5-2008

J. VanValkenburg

Material: Beryllium Copper

Potential Health Effects from Exposure to Beryllium Copper Alloy

Inhalation - People who are sensitive to inhaled beryllium particles can develop a serious and sometimes fatal lung disease, called chronic beryllium disease (CBD). Chronic (long-term) health effects may take months or years to develop. CBD is a condition, in which the tissues of the lungs become inflamed, restricting the exchange of oxygen between the lungs and the blood stream. CBD does not occur in most people, however, it is not currently possible to tell who is potentially allergic and who is not. Therefore, all workers need to be protected by implementing engineering controls and good work practices to control airborne particles containing beryllium. Three factors are required, and all must be present for a person to develop CBD. First, the individual must be exposed to airborne beryllium in the form of a dust, fume or mist. Second, the particles must be tiny enough to reach the air sacs deep in the lungs and thirdly, the person must be sensitive or allergic to beryllium. When particles containing beryllium that are sufficiently fine to be inhaled are deposited on hands, gloves or clothing, they could be transferred to the breathing zone and inhaled during normal hand to face motions. Care should be taken not to touch the face with contaminated hands or clothing. Wash hands if they become contaminated.

Cancer - Although beryllium has produced tumors in some laboratory animals, and is listed or suspected as a human carcinogen by some agencies, Brush Wellman believes there is no credible evidence that beryllium causes cancer in humans. In fact, the American Conference of Governmental Industrial Hygienists recently stated their belief that the risk of cancer is low in modern beryllium manufacturing plants. However, because cancer research is continuing, Brush Wellman recommends that caution be maintained since beryllium, like many other commonly used metals, has been listed by OSHA as a potential cancer hazard.

Additional Information

If you are concerned about the air quality in your work area; contact a qualified industrial hygienist to perform a process evaluation. Brush Wellman has provided training to nearly 100 industrial hygiene consultants across the US in hazard recognition and control of beryllium manufacturing operations. To obtain a list of consultants nearest you call the Brush Wellman product safety hotline listed below.

The information contained in the MSDS Supplement supplied by Brush Wellman and applies only to the subject referenced in the title. You must read the entire Material Safety Data Sheet specific to the products in use at your facility for detailed environmental, health, and safety guidance. If you need additional information, call the 24 hour product hotline at 800-862-4118 or 419-862-4118. Material Safety Data Sheets can be obtained by contacting Brush Wellman's web site at www.befacts.com.