LESSON PLAN

Date_____ Trade:- Welder

Name_____ Week No:- Twenty

Subject :- Brass-types-properties and welding methods. Copper-types-properties and welding methods.

Motivations:- in previous week we learned about Classification of steel. welding of low, medium, high carbon and alloy steel. Effects of alloying elements on steel. Stainless steel-types. weld decay and weld ability.

PREPARATION: - Teaching Aids:-Chalk, Charts,

INTRODUCTION: - Brass is a binary alloy composed of copper and zinc that has been produced for millennia and is valued for its workability, hardness, corrosion resistance and attractive appearance.

PRESENTATION:-

Topic	Information Point	Spot Hint
Brass Properties: • Alloy Type: Binary • Content: Copper & Zinc • Density: 8.3-8.7 g/cm^3 • Melting Point: 1652-1724 °F (900-940 °C) • Moh's Hardness: 3-4 **Characteristics:** The exact properties of different brasses depend on the composition of the brass alloy, particularly the copper-zinc ratio. In general, however, all brasses are valued for their machinability, or the ease with which the metal can be formed into desired shapes and forms while retaining high strength. While there are differences between brasses with high and low zinc contents, all brasses are considered malleable and ductile (low zinc brasses more so). Due to its low melting point, brass can also be cast relatively easily. However, for casting applications, a high zinc content is usually preferred. Brasses with a lower zinc content can be easily cold worked, welded and brazed. A high copper content also allows the metal to form a protective oxide layer (patina) on its surface that guards against further corrosion, a valuable property in applications that expose the metal to moisture and weathering. The metal has both good heat and electrical conductivity (it's electrical conductivity can from 23% to 44% that of pure copper), and it is wear and spark resistant. Like copper, its bacteriostatic properties have resulted in its use in bathroom fixtures and healthcare facilities. Brass is considered a low friction and non-magnetic alloy, while its acoustic properties have		

resulted in its use in many 'brass band' musical instruments.
Artists and architects value the metal's aesthetic properties, as it can be produced in a range of colors, from deep red to golden yellow.

Types:

'Brass' is a generic term that refers to a wide range of copper-zinc alloys. In fact, there are over 60 different types of brass specified by EN (European Norm) Standards. These alloys can have a wide range of different compositions depending upon the properties required for a particular application.

Production:

Brass is most often produced from copper scrap and zinc ingots. Scrap copper is selected based on its impurities, as certain additional elements are desired in order to produce the exact grade of brass required.
Because zinc begins to boil and vaporize at 1665°F (907°C), below copper's melting point 1981° F (1083°C), the copper must first be melted. Once melted, zinc is added at a ratio appropriate for the grade of brass being produced. While some allowance is still made for zinc loss to vaporization.
At this point, any other additional metals, such as lead, aluminum, silicon or arsenic, are added to the mixture to create the desired alloy.
Once the molten alloy is ready, it is poured into molds where it solidifies into large slabs or billets Billets - most often of alpha-beta brass - can directly be processed into wires, pipes and tubes via hot extrusion, which involves pushing the heated metal through a die, or hot forging.
If not extruded or forged, the billets are then reheated and fed through steel rollers (a process known as hot rolling). The result is slabs with a thickness of less than half an inch (<13mm).
After cooling, the brass is then fed through a milling machine, or scalper, that cuts a thin layer from the metal in order to remove surface casting defects and oxide.
Under a gas atmosphere to prevent oxidization, the alloy is heated and rolled again, a process known as annealing, before it is rolled again at cooler temperatures (cold rolling) to sheets of about 0.1" (2.5mm) thick.
The cold rolling process deforms the internal grain structure of the brass, resulting in a much stronger and harder metal. This step can be repeated until the desired thickness or hardness is achieved.
Finally, the sheets are sawed and sheared to produce the width and length required.
All sheets, cast, forged and extruded brass materials are given a chemical bath, usually used hydrochloric and sulfuric acid to remove black copper oxide scale and tarnish.

Applications:

Brass's valuable properties and relative ease of production has made it one of the mostly widely used alloys. Compiling a complete list of all of brass's applications would be a colossal task, but to get an idea of industries and the types of products in which brass is found we can categorize and summarize some end-uses based on the grade of brass used:
Free cutting brass (e.g. C38500 or 60/40 brass):

- Nuts, bolts, threaded parts
- Terminals
- Jets
- Taps
- Injectors

Brass types

Class	Copper (%)	Zinc (%)	Notes
Alpha brasses	> 65	< 35	Alpha brasses are malleable, can be worked cold, and are used in pressing, forging, or similar applications. They contain only one phase, with face-centered cubic crystal structure. With their high proportion of copper, these brasses have a more golden hue than others
Alpha-beta brasses	55–65	35–45	Also called **duplex brasses**, these are suited for hot working. They contain both α and β' phases; the β'-phase is body-centered cubic and is harder and stronger than α. Alpha-beta brasses are usually worked hot. The higher proportion of zinc means these brasses are brighter than alpha brasses.
Beta brasses[*citation needed*]	50–55	45–50	Beta brasses can only be worked hot, and are harder, stronger, and suitable for casting. The high zinc-low copper content means these are some of the brightest and least-golden of the common brasses.
Gamma brasses	61–67	33–39	There are also Ag-Zn and Au-Zn gamma brasses, Ag 30–50%, Au 41%.[26]
White brass	< 50	> 50	These are too brittle for general use. The term may also refer to certain types of nickel silver alloys as well as Cu-Zn-Sn alloys with high proportions (typically 40%+) of tin and/or zinc, as well as predominantly zinc casting alloys with copper additives. These have virtually no yellow coloring at all, and instead have a much more silvery appearance.

Brass alloys

Alloy name	Copper (%)	Zinc (%)	Tin (%)	Lead (%)	Other	Notes
Abyssinian gold	90	10				
Admiralty brass	69	30	1			Tin inhibits loss of zinc in many environments.
Aich's alloy	60.66	36.58	1.02		1.74 iron	Designed for use in marine service owing to its corrosion resistance, hardness and toughness. A characteristic application is to the protection of ships' bottoms, but more modern methods of cathodic protection have rendered its use less common. Its appearance resembles that of gold.[27]
Aluminum brass	77.5	20.5			2% aluminum	Aluminum improves corrosion resistance. It is used for heat exchanger and condenser tubes.[28]
Arsenical brass					arsenic, frequently aluminum	Used for boiler fireboxes.

Cartridge brass (C260)	70	30	—	≤ 0.07 [29]		Good cold working properties. Used for ammunition cases, plumbing, and hardware.
Common brass	63	37				Also called **rivet brass**. Cheap and standard for cold working.
DZR brass					arsenic	Dezincification resistant brass with a small percentage of arsenic.
Delta metal	55	41-43			1-3% iron with the balance consisting of various other metals.	The proportions used make the material harder and suitable for valves and bearings.
Free machining brass (C360)	61.5	35.5		3	0.35% iron	Also called 360 or C360 brass. High machinability. Lead content 2.5%–3.7% [29]
Gilding metal	95	5				Softest type of brass commonly available. Gilding metal is typically used for ammunition bullet "jackets", *e.g.*, full metal jacket bullets. Almost red in color.
High brass	65	35				Has a high tensile strength and is used for springs, screws, and rivets.
Leaded brass				>0		An alpha-beta brass with an addition of lead for improved machinability.
Lead-free brass				< 0.25		Defined by California Assembly Bill AB 1953 contains "not more than 0.25 percent lead content".[15] Prior upper limit was 4%.
Low brass	80	20				Light golden color, very ductile; used for flexible metal hoses and metal bellows.
Manganese brass	70	29			1.3% manganese	Most notably used in making golden dollar coins in the United States.[30]
Muntz metal	60	40			traces of iron	Used as a lining on boats.
Naval brass	59	40	1			Similar to admiralty brass.
Nickel brass	70	24.5			5.5% nickel	Used to make pound coins in the pound sterling currency. Also the main constituent of the bi-metallic One Euro coin and the centre part of the Two Euro coin.
Nordic gold	89	5	1		5% aluminium	Used in 10, 20, and 50 cents euro coins.

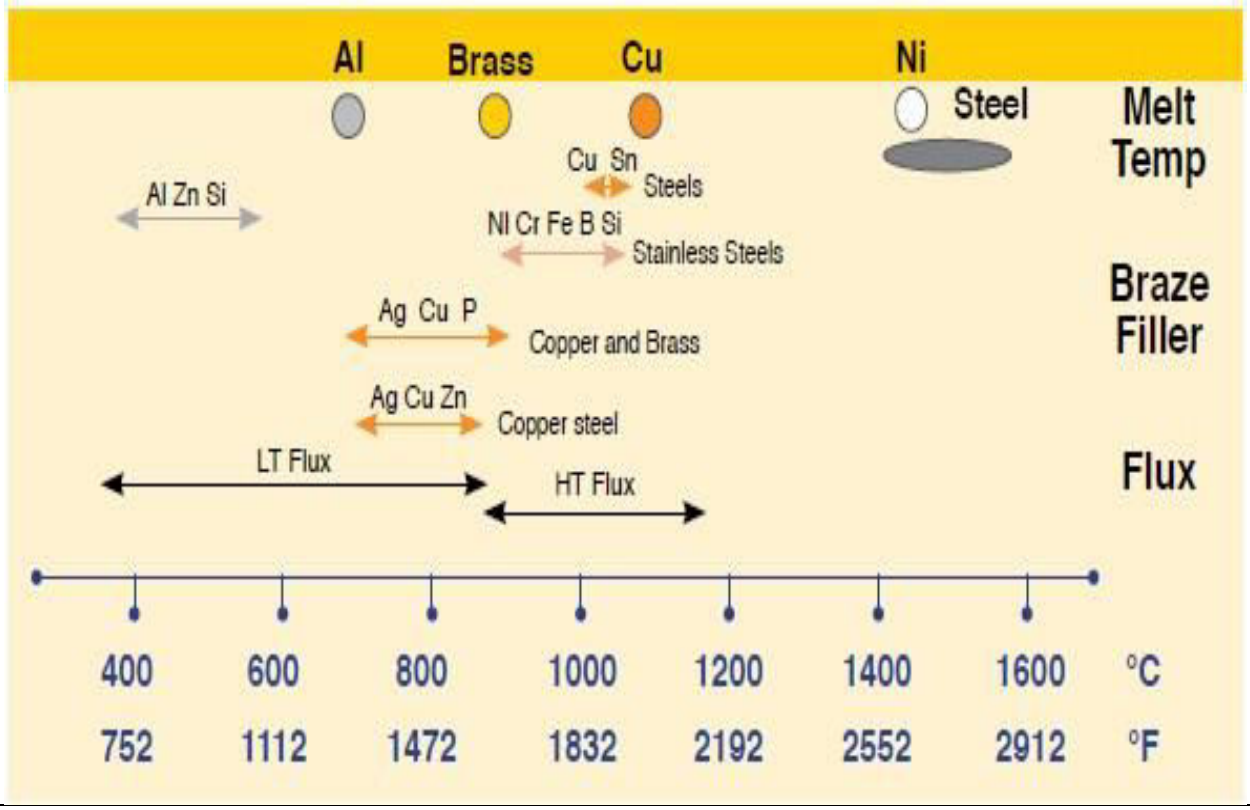
Prince's metal	75	25				A type of alpha brass. Due to its yellow color, it is used as an imitation of gold.[31] Also called **Prince Rupert's metal**, the alloy was named after Prince Rupert of the Rhine.
Red brass, Rose brass (C230)	85	5	5	5		Both an American term for the copper-zinc-tin alloy known as gunmetal, and an alloy which is considered both a brass and a bronze.[32][33] Red brass is also an alternative name for *copper alloy C23000*, which is composed of 14–16% zinc, a minimum 0.05% iron and minimum 0.07% lead content,[29] and the remainder copper.[34] It may also refer to ounce metal, another copper-zinc-tin alloy.
Rich low brass, Tombac		5–20				Often used in jewelry applications.
Silicon tombac	80	16			4% silicon	Used as an alternative for investment casted steel parts.
Tonval brass				>0		Also called CW617N or CZ122 or OT58. It is not recommended for seawater use, being susceptible to dezincification.[35][36]
Yellow brass	67	33				An American term for 33% zinc brass.

Weldingmethod of brass and copper:- due to composition of zink difficulties is vaporize zink during welding so we must use oxidizing flame .Copper is high sensitive metal and heat flow rate very high so we must use backing plate and intermittent welding methods.

Page 1

Copper is a metal with some very important properties, the main ones being its high electrical conductivity, its high thermal conductivity, its excellent resistance to corrosion, and its ease of fabrication, either hot or cold. Copper is also ductile and malleable and has a relatively low melting point at just over 1080°C. The three basic commercial grades of copper that are available are: Tough pitch copper, containing up to 0.1% oxygen Phosphorous deoxidised (PDO) copper, containing up to 0.04% phosphorus Oxygen-free copper, containing no deoxidants The phosphorus deoxidised grade was originally developed to overcome problems encountered when flame welding tough pitch copper. It is now the standard commercial weldable grade used for pressure vessels and radiators. Oxygen-free grades have significantly higher electrical conductivity than oxygen-containing grades and are therefore used widely as electrical conductors. Types Copper and copper alloys are generally grouped by compositional type and identified in standards by number or letter/number designations. However, it has been, and still is, common practice to refer to copper and copper alloys by their traditional names, such as brass and bronze, rather than by letters and number designations. Copper and copper alloys may be divided into groups by general composition, and each group contains a range of specific alloys. The main groups considered here are: Unalloyed copper Beryllium copper Brasses Bronzes Silicon bronzes Aluminium bronzes Cupro-nickels. Welding As has been stated earlier, copper has a very high thermal conductivity and a high coefficient of expansion. These provide the main problems encountered during welding of unalloyed copper. High levels of preheat and heat inputs are required for fusion welding. These in turn can cause distortion problems. Copper is also susceptible to hot cracking so heavy restraint needs to be avoided. The thermal conductivity of

many copper alloys is relatively low and welding without preheat may be possible. However, many alloys will crack readily when welded if too much heat is put into the weld area or if welding is carried out under restraint. Any copper alloys containing lead should not be welded. Welding Processes Copper and its alloys can be welded, most frequently using inert gas shielded processes, such as MIG and TIG. MMA is used occasionally for welding some copper alloys and gas welding and brazing are also used for some applications.



Questions:-

1. What is brass?
2. Right brass welding process.
3. Write three copper alloys.

Next Lesson:- Aluminum and its alloy, properties and weld ability, welding methods. Arc cutting and gauging.

Assignment:- Brass-types-properties and welding methods. Copper-types-properties and welding methods.

Checked by…….. Instructor……..