Experiment 3: Determination of percentage of Copper in brass using standard sodium thiosulphate solution

Significance of the experiment : Brass is an alloy made of copper and zinc; the proportions of zinc and copper can be varied to create a range of brasses with varying properties.[1] It is a substitutional alloy: atoms of the two constituents may replace each other within the same crystal structure. Brass is used for decoration for its bright gold-like appearance; for applications where low friction is required such as locks, gears, bearings, doorknobs, ammunition casings and valves; for plumbing and electrical applications; and extensively in brass musical instruments such as horns and bells where a combination of high workability (historically with hand tools) and durability is desired. It is also used in zippers. Brass is often used in situations in which it is important that sparks not be struck, such as in fittings and tools around explosive gases. The malleability and traditionally attributed acoustic properties of brass have made it the metal of choice for musical instruments such as the trombone, tuba, trumpet, cornet, baritone horn, euphonium, tenor horn, and French horn which are collectively known as brass instruments. Even though the saxophone is classified as a woodwind instrument and the harmonica is a free reed aero phone, both are also often made from brass. In organ pipes of the reed family, brass strips (called tongues) are used as the reeds, which beat against the shallot (or beat "through" the shallot in the case of a "free" reed). Brass has higher malleability than bronze or zinc. The relatively low melting pointof brass (900 to 940 °C, 1652 to 1724 °F, depending on composition) and its flow characteristics make it a relatively easy material to cast. By varying the proportions of copper and zinc, the properties of the brass can be changed,[2] allowing hard and soft brasses, thus in order to know the properties and uses of particular brass, it is important to know the percentage of copper in brass.

Aim : To determine percentage of copper in brass using standard sodium thiosulphate solution.

Principle : The chief constituents of brass alloys are copper and zinc. It also contains small quantities of tin, lead and iron. The percentage composition of a typical brass alloy is

Cu : 50 - 90% Zn : 20 - 40% Sn : 0-6% Pb : 0.2% Fe : 0-1%

A solution of brass sample is made by dissolving the sample in minimum amount of nitric acid. Excess of nitric acid is destroyed by boiling with urea. The solution is neutralized and made faintly acidic. Potassium iodide solution is added when the cupric ions oxidize iodide to iodine. The iodine liberated is titrated against sodium thiosulfate using starch as indicator. The volume of sodium thiosulfate consumed is a measure of the amount of copper present.

$$Cu + 2H^{+} \longrightarrow Cu^{2+} + H_2$$

$$Cu^{2+} + 4KI \longrightarrow Cu_2I_2 + 4K^{+} + I_2$$

$$2\ Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$$

Procedure:

Part A: Dissolution of the brass sample:

Weigh the given brass sample accurately and transfer it into a clean conical flask. Add 1:1 nitric acid drop wise till foil gets dissolve completely. To this add 1 t.t. distilled water and boil the solution gently till all the brown colored oxides of nitrgen fumes are expelled completely, and then add 1.0g of urea. Continue boiling for some more time to expel all the oxides of nitrogen fumes. Finally, add half test tube of ion exchange water and cool it properly.

Part B: Estimation of copper

To the above prepared brass solution in the conical flask, add dilute ammonium hydroxide drop wise until bluish white precipitate is formed. Dissolve the precipitate by adding 5 ml dilute acetic acid. Add 10 ml of 10% KI solution. Titrate the liberated iodine against standard sodium thiosulphate solution till the mixture turns straw yellow. Add 2 cm^3 starch indicator and continue the titration till the blue colour changes to white precipitate.

[Note: Conduct the entire experiment i.e., Part - A and Part - B in duplicate]

Results:

The percentage of copper in the given brass sample = 1……

= 2…….

= 3……..

Links to the external sources of information about the topic:

1. http://en.wikipedia.org/wiki/Brass
2. http://wwwchem.uwimona.edu.jm/courses/copper.html

Experiment 3: Observation and Calculations

Part A: Preparation of brass solution

	I	II	III
1. Weight of bottle + brass foil = W_2 =	----------g	----------g	----------g
2. Weight of empty bottle = W_1 =	----------g	----------g	----------g
3. Weight of brass foil = W_2-W_1 =	----------g	----------g	----------g

Part B: Estimation of copper

Weight of brass foil (g)			
Burette reading	**Trial** I	**Trial** II	**Trial** III
Final reading			
Initial reading			
Volume of $Na_2S_2O_3$ run down (mL)			

Volume of $Na_2S_2O_3$ consumed = ---------- mL (*a*)

Normality of$Na_2S_2O_3$ = ---------- (*b*). (`*b*' will be provided to you).

1000 mL of 1N$Na_2S_2O_3$ = 63.54 g of copper (molar mass of copper = 63.54 g)

`*a*' mL of `*b*' N $Na_2S_2O_3$ = $\frac{63.54\ Xa\ X\ b}{1000\ X\ 1}$ of copper = ---------- g (*c*)

Percentage of copper in given brass solution = $\frac{c\ X\ 100}{Weight of brass\ (g)}$

Results:

The percentage of copper in the given brass sample = 1……

= 2…….

= 3……..