SURFACE MODIFICATION OF BRASS FOIL

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Abstract:

A copper-based alloy is which the main additive is zinc (up to 50 percent). Brass is an alloy of copper and zinc. It has good hot and cold pressure workability, excellent mechanical properties, attractive color, and relatively low cost [1]. Brasses are resistant to corrosion in many media. Brasses are particularly susceptible to corrosion by solutions containing ammonia or amines. Alloys with more than about 15% of zinc may suffer dezincification, which leaves a weak, porous corrosion deposit of copper. Stress corrosion cracking, particularly by ammonia and amines, is also a problem with the brasses. Alloys containing more than about 15% zinc are most susceptible. Use of the annealed temper, and annealing or stress relieving after forming, reduces susceptibility to stress corrosion cracking. We have different types of brass materials like alpha, alpha-beta, beta and white. Classification of brass is depending upon the composition of copper and zinc. In this project the structure of untreated brass foil and brominated brass foil is studied. Here we used different experimental techniques like Energy Dispersive X-ray Spectroscopy (EDS), x-ray Diffractometer and field emission scanning electron microscope. Elemental composition is known by EDS data, structure of foil is known by XRD data [3], FESEM produces clearer, less electrostatically distorted images.

KEY WORDS:

Brass foil, crystal structure, Energy Dispersive x-ray Spectroscopy (EDS), X-ray Diffractometer and Field Emission Scanning Electron Microscope.

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 cubic crystal.
Alpha-beta brasses	55–65	35–45	Also called duplex brasses. Suited for hot working. It contains both α and β' phase; the β'-phase is body-centered cubic and is harder and stronger than α. Alpha-beta brasses are usually worked hot.
Beta brasses	50–55	45–50	Can only be worked hot, and are harder, stronger, and suitable for casting.
White brass	<50	>50	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 additive.

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The classification is clearly explained in this table.

I. INTRODUCTION:

In this phase diagram [5], α- phase is FCC, β &β' are BCC, γ is a complex structure.

II. EXPERIMENTAL TECHNIQUES:

Various techniques were used to study the different properties of the material while doing the project. These techniques include X-ray Diffractometer (XRD) to determine the structural properties, field emission Scanning electron microscope (FESEM) and Energy Dispersive X-ray

Element	Weight %	Atomic %
Cu K	60.66	61.34
Zn K	39.34	38.66
Total	100.0	

Spectroscopy (EDS). In this chapter each of the above techniques is explained briefly.

2.1.Energy Dispersive X-ray Spectroscopy (EDS)

EDS identifies the elemental composition of materials imaged in a Scanning Electron Microscope (SEM) for all elements with an atomic number greater than boron. Most elements are detected at concentrations on the order of 0.1%.

2.2. Principle of Operation of SEM:

As the electron beam of the SEM is scanned across the sample surface, it generates X-ray fluorescence from the atoms in its path. The energy of each X-ray photon is characteristic of the element which produced it. The EDS microanalysis system collects the X-rays, sorts and plots them by energy, and automatically identifies and labels the elements responsible for the peaks in this energy distribution.

The EDS data are typically compared with either known or computer-generated standards to produce a full quantitative analysis showing the sample composition.

2.3. X-RAY DIFFRACTION:

The properties of a material can often be linked back to the arrangement of atoms in its crystal structure. X-ray diffraction [3] is a non-destructive analytical technique which can yield the unique fingerprint of Bragg reflections associated with a crystal structure.

One can regard a crystal structure as being built of layers, or planes, which each act as a semi-transparent mirror. X-rays with a wavelength similar to the distances between these planes can be reflected such that the angle of reflection is equal to the angle of incidence. We call this behavior `diffraction´ and it is described by Bragg's Law.

$$2d\sin\theta = n\lambda$$

When Bragg´s Law is satisfied, constructive interference of diffracted X-ray beams occur and a `Bragg reflection´ will be picked up by a detector scanning at this angle. The positions of these reflections tell us about the inter-layer spacing of atoms in the crystal structure, thanks to Bragg´s Law. Peak intensities give information about how much X-ray scattering is contributing to that reflection.

2.4. Field Emission Scanning Electron Microscopy (FESEM):

Principle of Operation:

A field-emission cathode in the electron gun of a scanning electron microscope provides narrower probing beams at low as well as high electron energy, resulting in both improved spatial resolution and minimized sample charging and damage. For applications which demand the highest magnification possible, we also offer In-lens FESEM.

Why Field Emission SEM?

• FESEM produces clearer, less electro statically distorted images with spatial resolution down to 1 1/2 nm. That's 3 to 6 times better than conventional SEM.

• Smaller-area contamination spots can be examined at electron accelerating voltages compatible with Energy Dispersive X-ray Spectroscopy.

R A

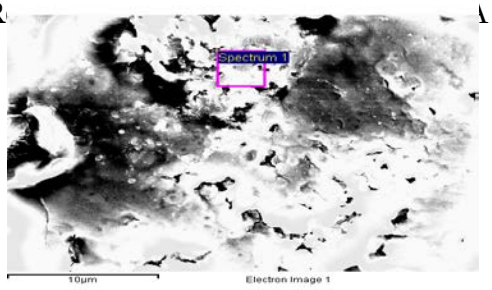


Fig1a:

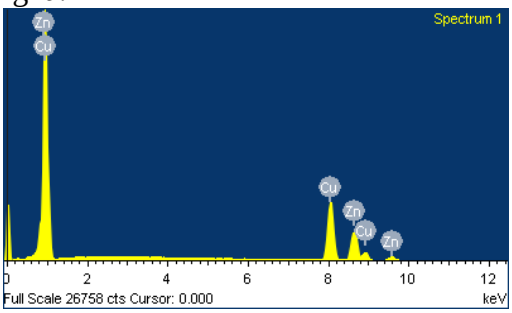


fig 1b: Shows the Morphology of Brassfoil

Element	Weight%	Atomic%
C K	3.12	12.67
O K	9.25	28.24
Ca K	0.71	0.86
e K	3.50	3.06
Cu K	4.68	3.60
Zn K	25.21	18.84
Br L	53.54	32.73
Totals	100.00	

Fig 2a: shows the % of elements after bromination

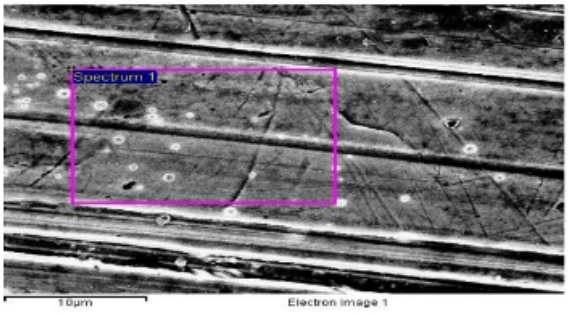


Fig: 2b Morphology of brominated brass

III. XRD data:[3] PURE BRASS & BROMINATED BRASS

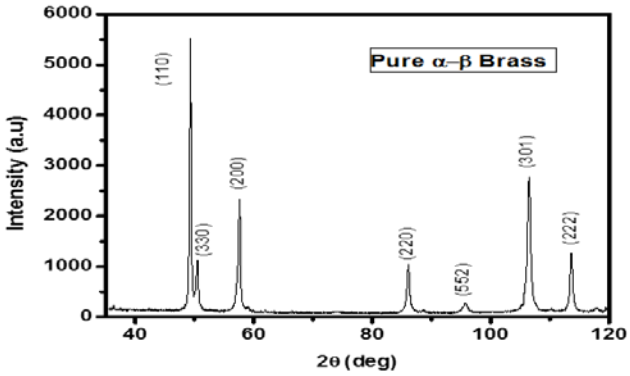


Fig 3a. XRD pattern of pure α-β brass

Clearly shows the α-β brass with cubic structure Crystallite sizes and lattice parameters [4] found as 27 nm.

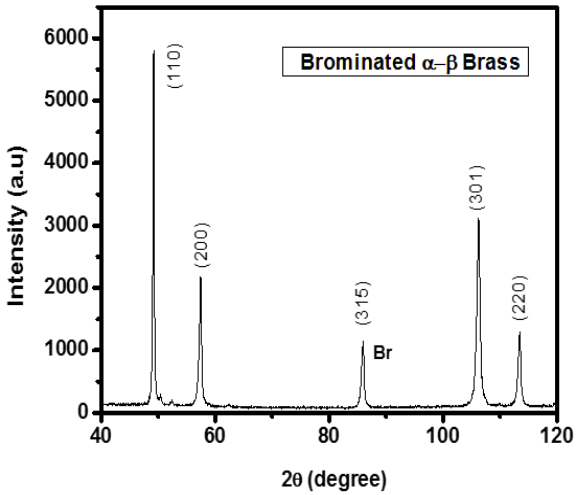


Fig 3b. XRDpattern of brominated

fo

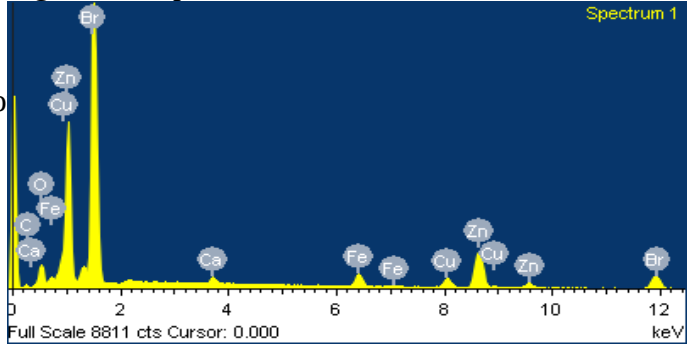
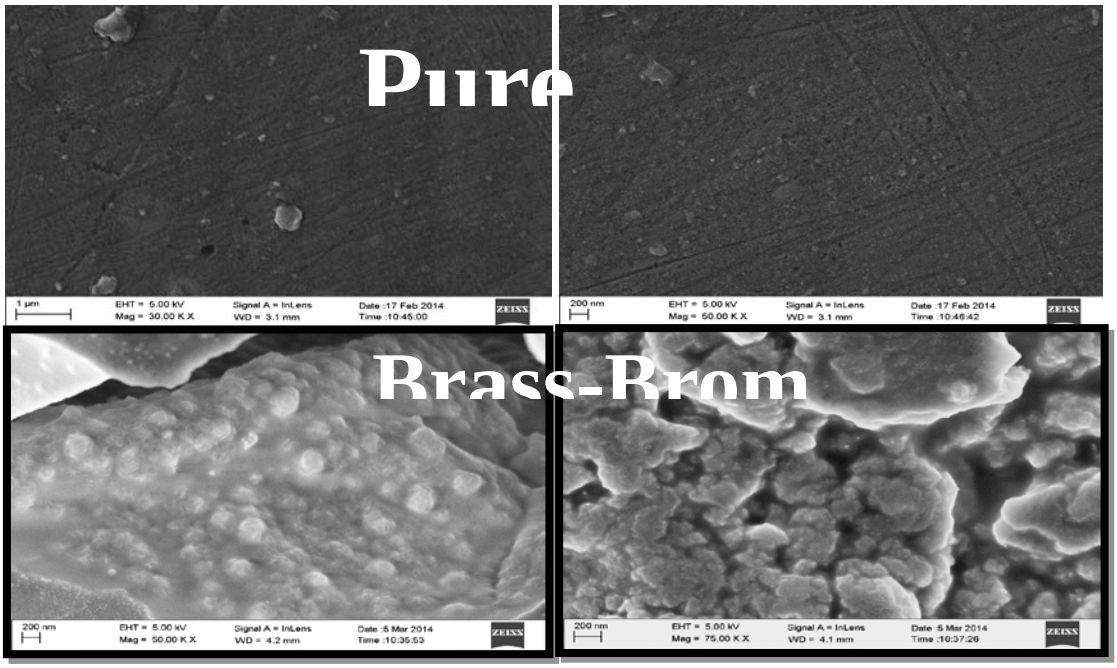


Fig 4. FESEM images clearly show s pure brass foil and brominated brass foil.



FESEM images of pure brass shows a microstructure with highly visible cracks in low and high magnification also but in case of bromine treatment we observed small cluster nanoparticles with 50-80 nm regimes. In figure Bromine brass shows very good image with clean morphology of nano-flake type morphology [6] with controlled dimension.

IV. CONCLUSIONS

The objective of the work in this project to modify the surface of commercial brass foil. Initial thickness of the brass foil is 0.4mm.To do this modification bromination technique was used. Initial structure of this foil without any treatment is cubic, after bromination structure changes to hexagonal.

From EDS data I deduced the composition of copper and zinc in the foil. From XRD, I knew the structure and crystallite size of my foil before and after treatment. From FESEM, I knew the morphology of my sample.

This preliminary work provides motivation for a detailed future study of structure, phase transition and phase stability of surface modified brass.

REFERENCE:

[1]. Smiriagin, A. P. Promyshlennye tsvetnye metally I splavy, 2nd ed. Moscow, 1956.

[2]. Khurmi, R.S. and Gupta, J.K. (2004) engineering designer, 30, 6 and J.K.Gupta 44120476

[3]. Swanson, H.E., Gilfrich, T. and Ugrinie, M. (1955) Standard X-Ray Diffraction Powder patterns.

[4]. Crystallography for solid state physics Lattice Geometry: Crystallographic formulae from appendix 3.2 pg.no.94.

[5]. Substitutional solid solutions –Home Ruthery rules –chapter 22, pg.no.625. [Phase diagram]

[6]. Crystallography applied to solid state physics by A.R.Verma & O.N. Srivastava from chapter 3, pg.no. 65 [morphology and angular relationships].