Mechanical and Corrosion Properties of Cold Working Brass

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Abstract
The key issue for manufacturing industries is the high surface quality of metal products the reasons for deforming engineering metal and alloys are to change their properties. The main object of present work is to investigate the effect of cold rolling on brass and understanding the relationship between surface roughness with cold reduction in cross- sectional are samples this study was concentrated on the corrosion behavior of cold working brass. The results show that the degree of deformation increase surface roughness of brass alloy. The weight loss increase with increasing time of immersion degree of deformation.
Keywords: brass alloy, cold rolling, surface roughness, corrosion , weight-loss.

1. Introduction

The working piece by two rotating rolls is known as plastic deformation whereby rolling is a metal working operation. It is noticed that when there is large surface of area, the rolling is used in a wide range, it has two significant qualities of the forming operation: advantage one it has an economical quality in the process of manufacturing and at the same time there is a loss in metal in it . Second advantage, using strength of the products through strain hardening and it is considered part of energy (1). If we want to optimize the metal's properties under high plastic deformation at high strain rates, it is very important to know and understand their behavior which is different from that of low strain rates (2). Brasses are considered as an industrial material which are used greatly because of their significant features like the resistance of high corrosion, the ability of deformation of good plastic and non-magnetism machinability (3).

The properties of the structure material are influenced greatly by the cold rolling and that is so because when we take the prior conditions in consideration we notice that no recrystallization can happen The grains extend toward rolling can occur and the order of the crystallographic latte has a directional quality. The pearlitic blocks, inclusions are developing banding character of other structural phases.

There are three kinds of texture arising (i.e. the texture and its structure and crystallography) that results in the mechanical properties that have a directional quality (4). Such texture development must be closely related to the microstructural evolution drying the cold rolling. The final feature microstructure and its influencing factors after annealing mostly belong: the primary structural characteristics of material before cold forming, the total cold reduction, (temperature and time) the speed of cooling, and also the condition of annealing (4-9). In this field of processing has been used more and more of progressive kinds of material (10,11). The mechanical features of brass rely greatly on the zinc 's content and the deformation degree through the process of production, and so, especially the temperature of recrystallization on the parameters of heat treatment (12-15). The surface of metallic material is polished out and the surface gets work hardened because of the deformation of the plastic, and the material left with the remaining stress distribution which appear compressive on the surface. This process promotes higher wear resistance, good surface quality, better roundness, maximum compressive residual stress, and evolve tensile strength and develop fatigue strength by through placing compressive stress on the work piece's surface (16). The goal of this study was to understanding and examining the influence of the cold deformation surface roughness of brass alloy. In the weight loss measurements and brass specimens were covered with water in 50 ml of the solution test of sodium chloride solution at concentration (3.5) %NaCl solution. The metal specimens immersed at 24,48 and 72 hours at room temperature.

2 .Experimental

The material used in this study is brass. The compositions of the brass was determined by means of chemical analysis in (planning / central organization for standardization and Quality control), Table 1 shows the chemical composition of the investigate brass. The amount of copper and zinc in the investigated brass is about to 72.7439% and 27%. The samples with dimensions (100*50*6) mm annealed at 400 c for 60 min were rolled in several passes and one reduction 1 mm. Entail thickness of cold rolled was 6 mm, which was reduced to 5 mm, 4mm, 3mm, and 2mm by 33.3%, 50, 66.6 and 83.3% cold reduction respectively. We used an optical microscope to realize the Metallographic scanning. After a cold rolling, we accomplished the Metallographic tests on cross sections of brass. We used the reagent to etch the cross section, and this reagent contained 3g ferriechloride ($FeCl3$), Hydrochloride acid (HCl) and ethanol ($C2H OH$) (15).

The surface roughness of specimen was measured by using device Perthometer - SP to measure the surface roughness. The diluted hydrochloric acid was used to clean every sample, then it is followed by methanol and acetone to get rid of everything that took place on the surface of the samples such as any cortex or dirt's. To measure the weight loss, we immerse brass specimens totally in 50 ml of the solution test of sodium chloride section at concertation (3.5) % NaCl solution. In room temperature the metal specimens immersed at 24,48 and 72 hours . we use the difference in in weight of the specimens to measure weight loss before and after immersion determined using LP 120 digital balance with sensitivity of 1 mg.

3. Results and discussion

Figure one shows surface roughness decrease with increase in degree of deformation of brass sample with 33.3%, 50%, 66.6% and 83,3 % cold reduction respectively Through the grain size and thickness strain, the surface roughness is increased or with Von Mises (17), grain size is one of the main factor which lead to surface roughness. it has been shown from experimental results the larger the grain, the rougher the surface (18) Cold working finishing process can create residual compressive stresses and good surface finish at metallic surface layers (19) .The light microscopy in polarized light was used to monitor the development of grain structure, after etching as shown in figure (2-3). Figure(3) Optical microscopy show the grain size substantially and shows the effect of the roll that can be seen on the grain arrangement. Because of the cold rolling there are arrow grains in 1mm thick sheets and these narrow grains is extended in the rolling direction. We use the mingled hydrochloric acid to clean the sample, then is followed by using acetone and methanol to get rid of the dirts or cortex which is shaped on the samples' surface. The sample must be soaked up in each solution about 2minutes and making it dry after every step by using air blower .The weight loss of brass at concentration of 3.5% NaCl solution at room temperature are given in figure (4 to 6) The weight loss of brass at concentration of 3.5% NaCl solution at room temperature are given in figure (4 to 6) The difference of weight loss with reduction of brass sea water 3.5 % Na Cl at 24 hours. The weight loss increase with increasing of time immersion the maximum weight loss of each compound was achieved at 83.3 % cold reduction. From figure (4 to 6) the increment in time of immersion is increased the weight loss. The variation in weight loss with difference time of immersion is increased by the the increasing cold reduction , the high dislocation density is made by the cold working and this case can increase the stored energy of the metal and as a results the weight loss increases too. When the metal surface increase the tendency of metal to corrosion, it intersect with the strain field and energy of dislocation line. Figure 5 the difference of weight loss with reduction of brass sea water 3.5% NaCl solation at 42 hours Figure 6 – the difference of weight loss with reduction of brass sea water 3.5% NaCl solution at 72 hours

4. Conclusion

The high surface quality of metal products is the best parameter of surface roughness, surface quality of col metal manufactured products in an important point in metal manufacturing. From the results obtained by testing samples, it can be concluded:

- when the cold reduction increases, also weight loss on brass alloy increases too.
- This work is a conected investigation based on experiments ,it is about all the relationships between roughness , and during degree of deformation microstructure in a cold brass alloy .
- Roughness decreases with the increasing in degree of deformation of brass sampleswith 33.3%, 50%, 66.6%, and 83,3% cold reduction respectively.

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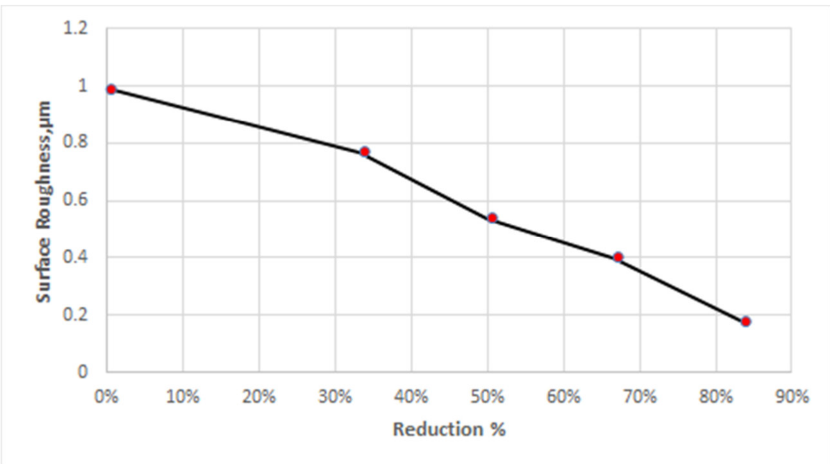

Figure 1. Relationship between surface roughness and reduction

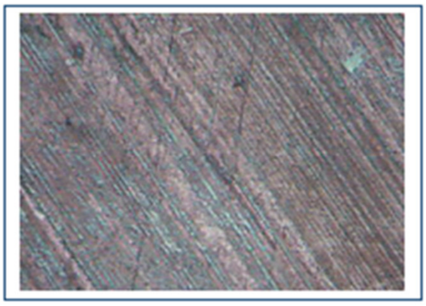

Figure 2. Optical micrographs of brass

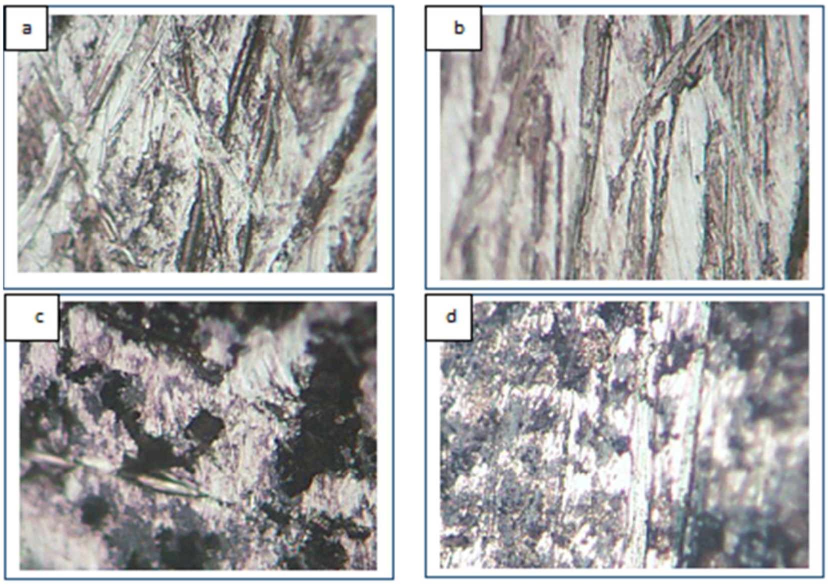

Figure 3. Optical micrographs of brass cold rolled by (a) 33%, (b) 50% , (c) 66% ,and (d) 83.3% in thickness reduction

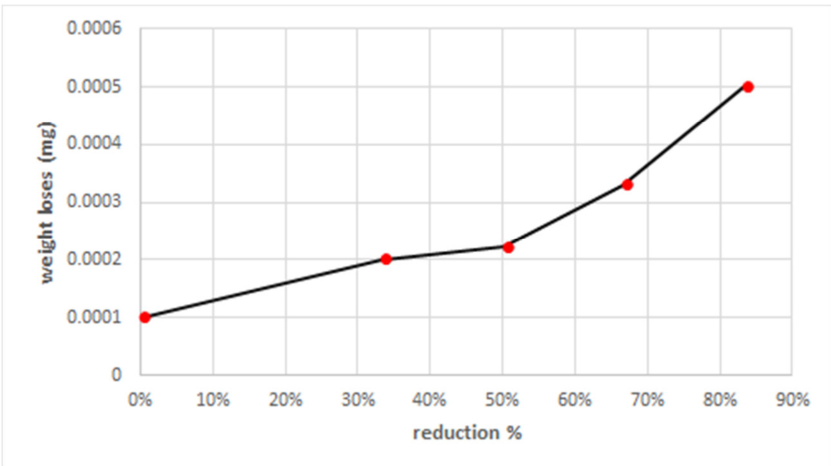

Figure 4. Variation of weight loss with reduction of brass sea water 3.5 % NaCl solution at 24 hours

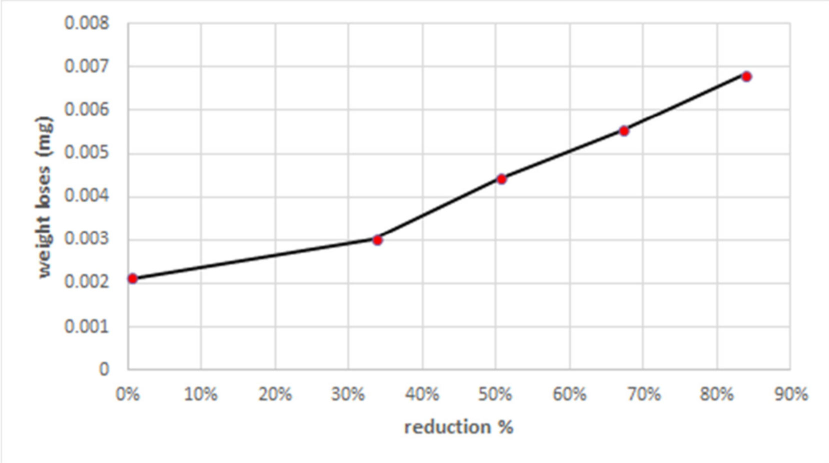

Figure 5. Variation of weight loss with reduction of brass sea water 3.5 % NaCl solution at 48 hours.

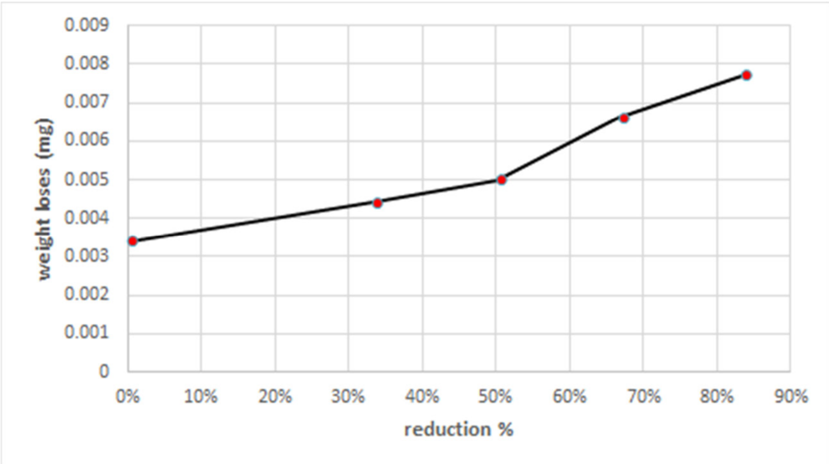

Figure 6. Variation of weight loss with reduction of brass sea water 3.5 % NaCl solution at 72 hours.

Table 1: chemical composition of brass (wt %).

Ni	Fe	Mn	Sn	P
0.005	0.001	0.006	0.006	0.008
Sb	Cd	Bi	Co	Ag
0.003	0.001	0.003	0.007	0.007

Table 2. Thickness of the samples and Degree of the rolling reduction of the brass after cold-rolling.

Designation of sheet strip	Thickness of the strip [mm]		Degree of the rolling reduction [%]
	ho	hl	
A0	6	-	-
A1	6	5	33.3
A2	6	4	50
A3	6	3	66.6
A4	6	2	83.3