Effect of Heat Treatment on the Electrochemical Behavior of Nickel Aluminum Bronze Alloy (C95500)

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1- Introduction

The effect of heat treatment of nickel-aluminum bronze alloy on the interaction of the cathodic surface and its corrosion behavior in 3.5% NaCl solution is studied.

Following in Table 1 and Table 2 are chemical compositions and type of heat treatments that were engaged in this research

Table 1 chemical composition of the used alloy (C95500) after casting

Material	Alloy Composition (wt%)					
	Cu	Ni	Al	Fe	Mn	Si
Alloy (C95500)	Bal.	4.8	10.3	4.5	0.9	0.06

Table 2 Heat treatments

Heat treatment	Sample	t **min**	T **°C**	time (t)	Temp. (T)
Water quench	A	30	900	---	---
Normalizing	B	30	900	---	---
Water quench	C	30	900	2 h	500
Normalizing	D	30	900	2 h	500°C

The alloy was studied under different industrially recommended heat treatments, including quenching, normalizing and aging heat treatments.

2- Results and Discussion

The microstructure of the specimens was studied by optical microscopy. Various phases were detected and the result can be seen in Fig. 1.

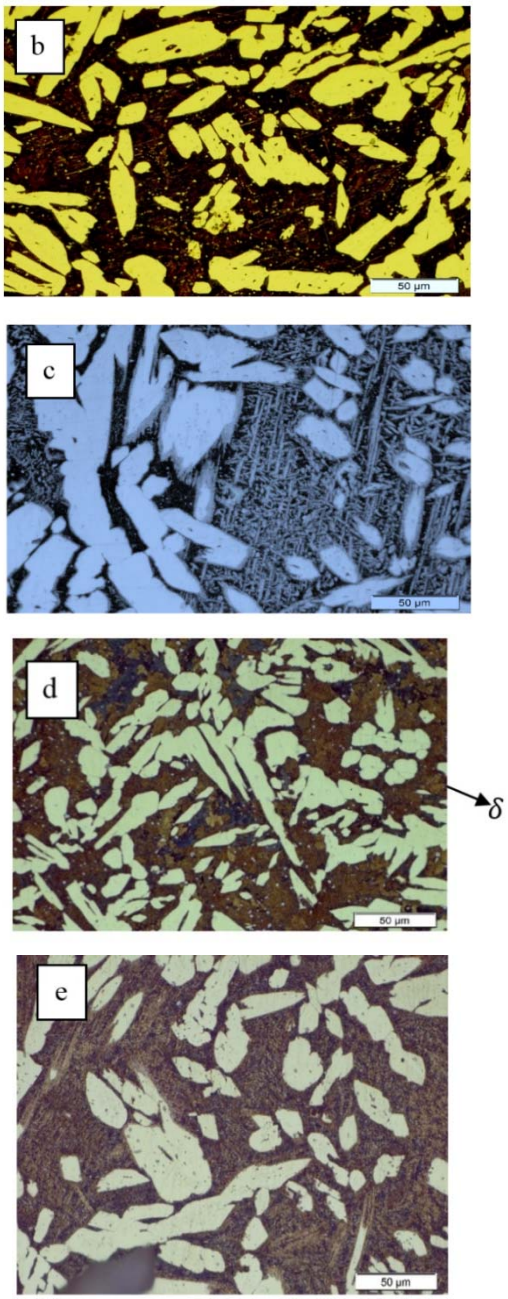

Fig. 1 The microstructure of the specimens studied by optical microscopy a. as cast, B, C, D and E

In corrosion part it will be shown that due to formation of protective layer, the presence of β′ phase improves the corrosion resistance of the alloy.

Polarization tests proved that with increasing immersion time, and the formation of the protective layer, the oxygen-diffusion controlled cathodic

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reactions are extended and also corrosion resistance is increased. Polarization curves showed that the anodic polarization behavior is almost the same for all samples, which suggests that activation is controlled by the heat treatment of the samples for anodic dissolution.

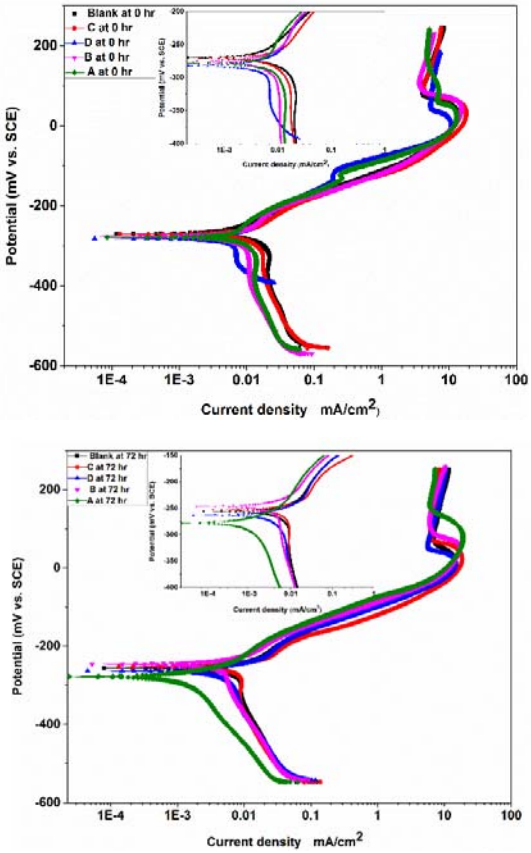

Fig. 2 Polarization curves after 0 and 72 hours exposed to 3.5% NaCl

Sample E (heat treated 30 min at 900 degrees Celsius and then water quenched) gives the best corrosion resistant alloy.

3- Conclusions

The effect of heat treatment of nickel-aluminum bronze alloy on the interaction of the cathodic surface and its corrosion behavior in 3.5% NaCl solution is studied The different behavior under the influence of cathodic polarization proves that the alloy also reflects the increase or decrease in the level of corrosion resistance.

Due to formation of surface protective layer, the presence of β′ phase improves the corrosion resistance of the alloy.

Sample E (heat treated 30 min at 900 degrees Celsius and then water quenched) gives the best corrosion resistant alloy.