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Microstructural defects in AISI 4000 series steel subjected to a 3% NaCl corrosion process.

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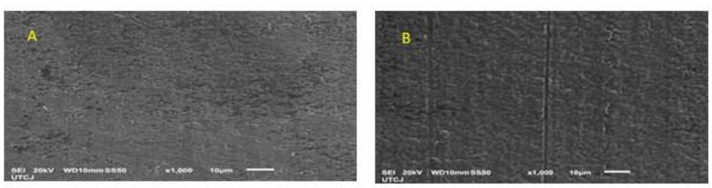
AISI 4000 Series Steel IS one of the most important materials used in engineering. Steel Stainless achieves this degree of importance because of its combination of strength, ease of fabrication, and a wide range of properties at low cost. Some steels are relatively soft, ductile, and can be quickly manufactured into automotive or aircraft parts [1]. These stainless steels maintain a stable ferritic structure from room temperature to melting point, so their corrosion resistance is considered moderate, which increases with chromium content [2]. The present work aims to identify the microstructural defects of two pieces of AISI 4000 Series Steel obtained from different manufacturing processes and subjected to an experimental process through electrochemical techniques to obtain their corrosion rate. This process consisted of immersing the pieces in a NaCl solution at 3% by weight at room temperature. For microstructural analysis, the chemical composition was verified by optical emission spectroscopy (OES) using Foundry Master equipment and Worldwide Analytical Systems AG (WAS) software and using x-ray energy dispersion spectroscopy (EDS), Figure 1. Scanning electron microscopy (SEM) was used to analyze the microstructural defects of the piece subjected to 3% NaCl. This microstructural analysis presents a contribution to the electrochemical technique to contribute and enrich the studies of resistance to corrosion of stainless steels. In figures 2, The pitting corrosion behavior induced by chloride ions can be seen (Red Arrow), which is a common situation in marine environments [3]. Structural defects on steel parts are considered slight, due to the concentration percentage and the exposure time of 23 hours at room temperature. Similarly, the spectra (OES) are presented for each of the areas of interest, verifying that it corresponds to the base metal of the AISI 4000 Series Steel pieces, the elements present are mainly Fe, Mn, Cr, W, Al and C, Mo, all elements of the alloy. Scanning electrochemical microscopy is a very appropriate technique for the local study of corrosion processes because it provides information on site, at micrometric and submicrometric scales, relative to the topography and electrochemical activity of reactive surfaces in aqueous solution [5].

Figure 1. Figure 1, EDS Spectra of AISI 4000 Series Steel parts exposed to a 3% Nacl corrosion process. The elements present are mainly Fe , Cr and C, Mo, all elements of the alloy.



Sample name	Average chemical composition (Weight /% W) *																				
	Fe	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Co	Cu	Nb	Ti	V	W	Pb	B	Ca	Zr	As	Bi
A	99.0	0.113	0.0342	0.418	0.043	0.03	0.0587	0.0232	0.0546	0.0429	<0.0100	0.0417	0.0075	0.0045	0.0107	<0.0250	<0.0500	-	-	-	-	-
B	98.9	0.116	0.0768	0.362	0.0034	<0.0030	0.0407	0.0650	0.0525	0.0365	0.0020	0.135	0.0124	0.0081	<0.0020	0.0128	<0.0500	0.0149	0.0002	0.0123	0.0051	<0.0900

Figure 2. Figure 2. SEM structural analysis, part A and B showing the presence of corrosion pitting pores (red arrows) and the chemical composition by OES. The composition is the result of the average of 9 "burns" distributed in three different locations of each sample.

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