ELECTROCHEMICAL STUDY OF THE SILICON AND SILICON/CRHOMIUM PROTECTIVE FILMS ON FINEMET TYPE ALLOYS.

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The amorphous metallic alloys which contain nanocrystals with lower size than a critical one, may be considered like homogeneous alloys and, sometimes, they may present a higher corrosion resistance than their respective amorphous alloys *(1)*.

The nanocrystalline *FINEMET* alloy, can be obtained through a controlled isothermal annealing on the respective amorphous alloy, at 570K aprox. *(2)*.

In this work, the effect of the isothermal annealing at 600ºC and at a temperature (T≈Tonset) below and next to the onset temperature at which appears the peak corresponding to nanocrystallization process (obtained by DSC), on electrochemical behaviours of the metallic glasses, which compositions are as follow:

$Fe_{73.5}\,Cu_1\,Nb_3\,Si_{16.5}\,B_6$ *(Si+3)*
$Fe_{73.5}\,Cu_1\,Nb_3\,Si_{10.5}\,B_{12}$ *(Si-3)*
$Fe_{69.5}\,Cr_4\,Cu_1\,Nb_3\,Si_{16.5}\,B_6$ *(Si+3Cr4)*
$Fe_{69.5}\,Cr_4\,Cu_1\,Nb_3\,Si_{10.5}\,B_{12}$ *(Si-3Cr4)*

namely, type FINEMET-Cr_x (x=0,4) alloys, with different Si/B relations, have been studied.

The crystallization process alloys and their crystallization temperatures, have been analized by Differential Scanning Calorimetry (DSC), while the corrosion resistance of the alloys have been studied by electrochemical techniques, such as: Cyclic Voltametry (CV), and Potentiodynamic Polarization (Lineal Scanning and Corrosion Test).

The results showed that the nanocrystallized at T≈Tonset alloys with higher Silicon content *(Si+3* and *Si+3Cr4)*, presented a better electrochemical behaviour than the respective amorphous ones. This behaviour is enhanced significantly in both alloys, when thermal annealing was carried out at 600ºC, possibly due to Silicon migration towards to the surface of the alloys, as active current density data show in the *Table-I.*

However, the synergetic effect betwen silicon and crhomium *(3)*, in both (600ºC and T≈Tonset) isothermally annealed alloys with higher silicon content and 4 at.% of crhomium *(Si+3Cr4*), improves their corrosion resistance and passivating ability due to the formation of passive films with high content in both protective elements, as it is observed in the *Figure-I.*

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References

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Alloys / State	As-Quenched	Annealed at T≈Tonset	Annealed at 600ºC
Si+3	**64.2**	**51.3**	**0.82**
Si-3	88.2	96	80.8
Si+3Cr4	**1.3**	**0**	**0**
Si-3Cr4	54.8	33.2	8

Table-I: Active current density of the alloys, as-quenched and isothermically annealed at several temperatures during 15 minutes, obtained in HCl 2N, at v=20mV.min^{-1}.

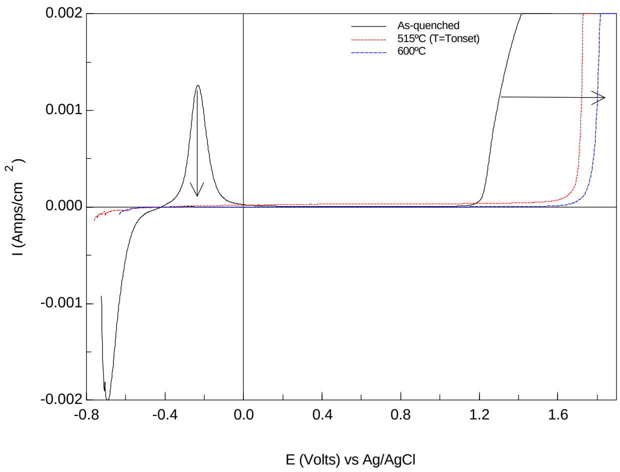

Figure-I: Potentiodinamic Polarization curves of the *Si+3Cr4* alloys, as-quenched and isothermically annealed at several temperatures during 15 minutes, obtained in HCl 2N, at v=20mV.min^{-1}.