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Study of the profile of layer formed in plasma nitride austenitic stainless steel

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The ASTM F138 and AISI 316L stainless steels are used as biomaterials and for industrial applications. Studies related to the application of plasma nitriding to such materials have been given much attention and it has been the subject of a systematic study in our research [1-5]. If temperatures up to 400^o C is used in the process, a nitrided layer of some micrometers is produced, which improves important properties in this context as high hardness, wear resistance and also corrosion resistance. The nitrided layer is formed by the **composite layer** which consists of iron and chromium nitrides, and concentrates on the surface, as well as the nitrogen **diffusion layer** which is located in the inner region, known as expanded austenite γ_N . Compared to matrix γ -phase reflections, γ_N -phase diffraction peaks are broader and shifted to lower angles. The $\gamma_N(200)$ peak positions are more deviated relatively to $\gamma(200)$ than other planes, demonstrating a distortion from the cubic fcc unit cell. Up to now, the crystalline structure of this phase is still a matter of debate and it has not been completely clarified. We have developed some measurements using synchrotron radiation, which allows for both a higher intensity and a better resolution, in order to elucidate this important phase formed in the nitriding process [4,5]. With the aim of investigate the depth distribution of composite layer of some ASTM F138 samples, which were nitrided at 400^o C at different conditions of AC voltage frequency, synchrotron radiation diffraction was carried out using 7.0 keV energy. The XRD patterns were measured using different grazing angles. Measurements revealed that the iron and chromium nitrides, from the composite layer, decrease rapidly with depth. The results will be presented and discussed, contributing to better elucidate this important phase formed in the nitriding process.

[1] S. D. de Souza, M. Olzon-Dionysio, E. J. Miola and C. O. Paiva-Santos. *Plasma Nitriding of sintered AISI 316L at Several Temperatures*- Surf. Coat. Technol. 184/2-3 (2004) 176.

[2] M. Olzon-Dionysio, S.D. de Souza, R.L.O. Basso, S. de Souza. *Application of Mössbauer spectroscopy to the study of corrosion resistance in NaCl solution of plasma nitrided AISI 316L stainless steel*-Surf. Coat. Technol. 202 (2008) 3607.

[3] S.D.de Souza, M.Olzon-Dionysio, R.L.O.Basso, S.de Souza *Mössbauer spectroscopy study on the corrosion resistance of plasma nitrided ASTM F138 stainless steel in chloride solution*-Mater.Character. (2010) 992 DOI 10.1016/j.matchar.2010.06.015

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[5] M. Campos, *Investigação das fases formadas na superfície do aço inoxidável AISI 316L nitretado a plasma*- São Carlos. PhD thesis-DF- UFSCar, Advisor : M.Olzon- Dionysio, finished in abril/2013.)

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