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CORRELATION BETWEEN MÖSSBAUER AND SYNCHROTRON X-RAY GRAZING ANGLE DIFFRACTION DATA ON THE CHARACTERIZATION OF NITRIDED AUSTENITIC STAINLESS STEEL

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Nitrided austenitic stainless steel (NASS) forms a nitrogen-supersaturated crystallographic phase known as expanded austenite (EA), which responds for the enhancement of its hardness, wear and corrosion resistance. However, a complete description of this crystallographic and ^{57}Fe hyperfine structures is currently not available in the scientific literature. Also, any side-formation of other nitride phases is not clear. In this work, the grazing angle incidence synchrotron radiation diffraction (GASRD) and conversion electron Mössbauer spectroscopy (CEMS) were used to explore the near surface region of this NASS (ASTM 316L with the following plasma nitriding parameters: temperature, 400 °C; time, 4 h; atmosphere, 80% H_2 + 20% N_2 at three different pressures, 4, 6 and 10 torr). GASRD settings allowed analyses at depths between 0,16 and 11 μm from the surface of the sample. Results reveal significant differences of the diffractogram patterns depending on the probing depth. As expected, the austenitic and the EA phases are detected at deepest layers of the sample. At more superficial sections, the austenitic phase virtually disappears and a broadening and shift for smaller angles is observed, as expected, for the EA. Nevertheless, at a superficial layer, the diffractogram presents other reflection peaks, due to Fe_4N and $Fe_{2-3}N$. The CEMS data for the ~0,1 μm depth is consistent with the GASRD results for the same sample depth. As conclusion, the used two analytical techniques allowed a reliable qualitative analysis of the NASS sample in the near surface region of the sample. It is also important to emphasize that the analysis of the submicron depth layers leads to distinct conclusions relatively to that for deeper regions, strengthening the importance of submicron analysis for this system.

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