Characterization of AISI 316 nitrided steel by TEM

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Plasma nitriding were performed at 723K for 5h in AISI 316 austenitic stainless steel samples, using 80% H_2 - 20% N_2 atmosphere at 5mbar. XRD analysis has showed that γ austenite and γ_N expanded austenite both are main constituents of microstructure. The later phase is resulting from colossal introduction of nitrogen into interstitial sites of FCC iron lattice, which presents a typical "anomalous" behavior of 2θ shift peaks in the XRD patterns. Plan-view thin foil samples for TEM have been prepared from nitrided layer. Very small rounded chromium nitrides (10-15nm) were observed in nitrided layer (Fig.1a) and were not identified by XRD due to their small volume fraction. Ring-type electron diffraction pattern showed together dark field image suggests that large number of these small particles were found, many of them presenting some texture/preferential orientation effect. Measurements of planar spacing obtained by selected area electron diffraction (SAED) have suggested that expanded austenite could be FCC, which lattice parameter changes among 3.8 to 4.1Å depending on used reflection. Some areas of thin foil have been observed with a lamellar type microstructure, as bright field micrograph presented in Fig.1(b). SAED analysis showed that feature was resulted from localized expanded austenite decomposition, which is composed, by ferrite and cubic chromium nitride. Occurrence of γ_N decomposition has been associated to decrease of wear and corrosion resistance of nitrided layer from austenitic stainless steels.
Keywords: Plasma nitriding, expanded austenite, chromium nitride, XRD, TEM.

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[1] F.A.P. Fernandes et al. Surface & Coatings Technology **204** (2010) 3087–3090.
[2] L.C. Gontijo et al. Materials Science Forum **638-642** (2010) 775-780.
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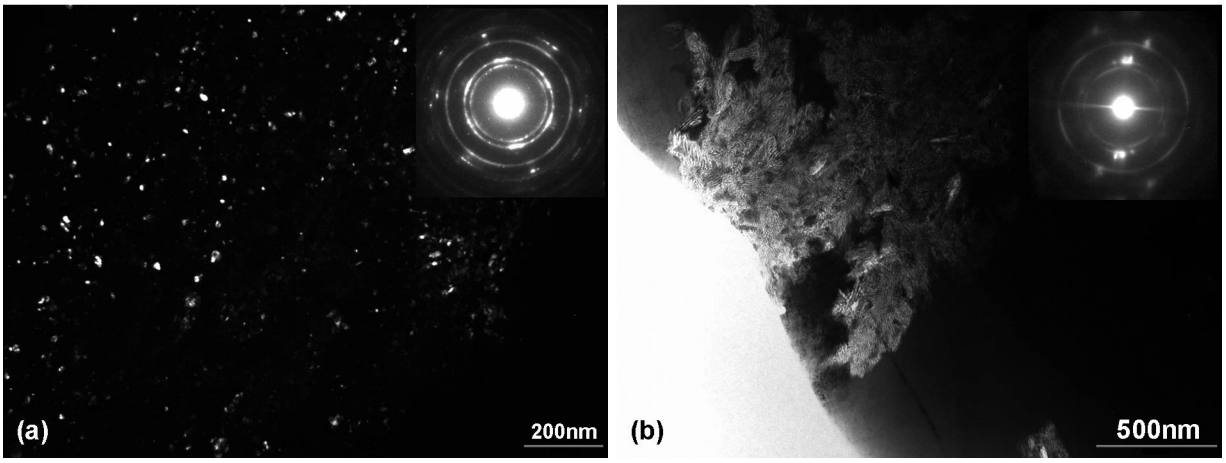

Fig.1: TEM micrographs: (a) Fine chromium nitride particles. (b) Lamellar γ_N decomposition.