s7.m2.p1 X-ray diffraction study of thin film elastic properties in relation with their microstructure. P. Goudeau , P.O. Renault, P. Villain and K.F. Badawi, *Laboratoire de Métallurgie Physique – UMR 6630 CNRS, Université de Poitiers – SP2MI, Téléport 2 - Bvd Marie et Pierre Curie, B.P. 30179, F-86962 Futuroscope Chasseneuil.*
Keywords: X-ray diffraction, thin films, elastic properties.

The development of thin films for industrial applications is constantly increasing because deposition techniques provide new class of materials which are impossible to obtain with classical elaboration processes. The structure which develops during thin film growth is tightly controlled by the deposition process [1]. Thin films deposited by sputtering technique on non epitaxial substrates are often nanocrystallines which confers to the film very interesting properties.

Depending on deposited atom energy, thin films adherent to bulk substrates are often in a tensile or compressive residual stress state which may affect their physical properties and reduce their life time. In order to get a better understanding of such residual stress effects, the determination of the thin film stress state in relation with the microstructure is then necessary.

Among the most widely used method to determine the stress level in thin films, x-ray diffraction is the unique non destructive technique which allows to determine both the mechanical and microstructural state of the film. The measurement of the diffraction peak position shift using $\sin^2\psi$ method allows to extract the stress tensor and the stress free lattice parameter. However, x-ray diffraction is difficult to use in thin films because the diffracted intensities are weak due to the reduced thickness and nanocrystalline structure of such materials. In order to solve these difficulties, we developed an original X-ray diffraction set-up [2]. Its main features are the followings: intense X-ray source (synchrotron radiation – SR), incident and diffracted X-ray path under vacuum and recording of the diagram with a proportional detector. Examples - (Ti,Si)N on steel, TiC interlayer in C-diam/TA6V set, δ-Zr on Si, Ag clusters embedded in a carbon matrix on Si - of SR experiments at Lure on beam line D22 using large x-ray wavelength (0.25-0.3 nm) will be given.

The determination of residual stresses from x-ray diffraction requires the knowledge of elastic constants. Combining an x-ray diffractometer with a tensile tester, it is thus possible to investigate x-ray elastic constant of diffracting phases in a thin film/substrate system [3]. The feasibility of such an experiment realised at Lure on beam line DW22 will be given as well as more recent investigations concerning elastic anisotropy of films.

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s7.m2.p2 The effect of nanostucture on the mechanical properties of high strength low alloy steel (HSLA steel). M.S. Shalaby ¶*Materials &Corrosion Science Prevention. Tech. Sector Director, DELTA STEEL MILL Co.EGYPT.Member, ESCA, ECS, EASRT & ACTIM Bag-Cairo 13, 11511 Delta Steel, EGYPT.*
Keywords: instrumentation, materials, synchrotron.

Tensile strength, fracture toughness and nanostructure analysis tests were performed on different grades of (HSLA steel) produced in eaf, at DSM Co. EGYPT. The fracture process was studied by analyzing the fracture surface by using Scanning Electron Microscope. The effect of plastic deformation in this ductile materials on its fracure toughness and grain size and grainbounderies was analyzed by using Transmission Electron Microscope.

Small-angle X-Ray Scattering (SAXS) Tech., and the procedure of data analysis in this study have been described in this paper.