RESIDUAL STRESS CHARACTERIZATION IN DLC COATING BY FOCUSED ION BEAM MILLING AND FINITE ELEMENT MODELING

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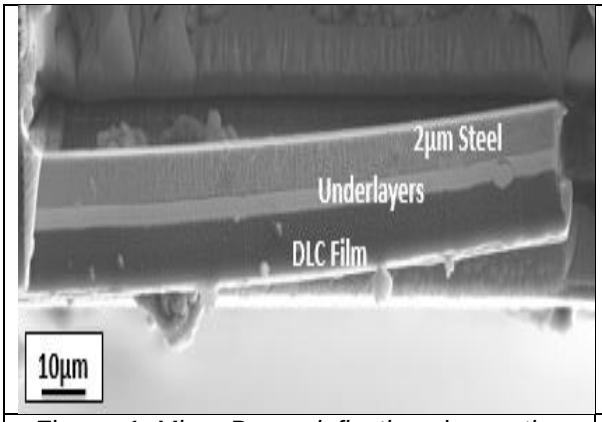
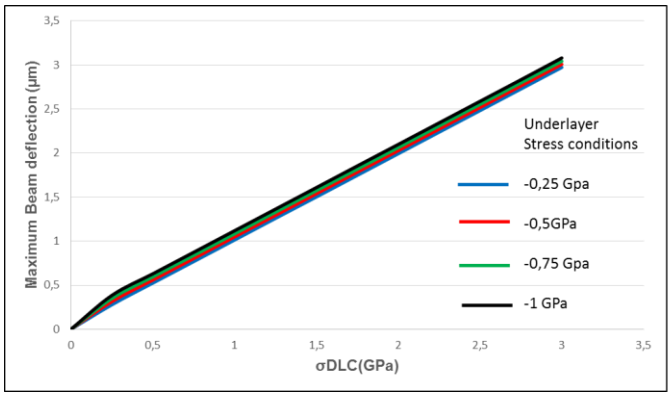
Low friction Diamond-Like-Carbon coatings have broad applications to reduce wear and improve lifetime products [1]. Cost efficient PECVD deposited DLC is especially used in the automotive industry. These fabrication process lead to large intrinsic compressive stresses and eventually in service delamination, blisters with cracks may occur. Hence, reliable measurement technics and mechanical models devoted to the local stress distribution reveal important for optimizing the mechanical properties of the materials.
Main characterization technics use X-Ray diffraction or a wafer curvature analysis [2]. However, they are limited to crystalline material and only provide an average and homogeneous stress distribution. More recently, new methods based on Focused Ion Beam milling allowed determining residual stress at a very local scale. It consists in strain relaxation SEM observations of micro-cantilevers or micro-pillars prepared by controlled material removal [3,4,5]. This present work is dedicated to the micro beam characterization and FEM modelling of the residual stresses in DLC coating on M2 steel substrate and an intermediate underlayer. Different micro-beams were milled and their maximum deflection measured Fig1a. Simultaneously a FEM analysis was carried out to study the parameters that influence le micro-beam flection. By a combination of the FIB-experimental method and the numerical investigation, we will aim to determine the residual stress on DLC coating either on the sublayers according to the geometry of the cantilever and its deflection.



Figurer 1: Micro-Beam deflection observation by SEM



Figurer 2: FEM modeling of DLC residual stress

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