

THERMO-MECHANICAL BEHAVIOUR OF THIN FILMS AND SMALL STRUCTURES CHARACTERIZED BY SYNCHROTRON X-RAY DIFFRACTION

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Several efforts have been made to characterize structural properties and mechanical state of small material volumes. The challenge of the interlinking residual stress state and the local structure has been hindered mostly by the spatial resolution of the diffraction techniques and compositional gradients on the nano-scale.

Recently, the application of synchrotron X-ray beams with micron or sub-micron sizes and high brilliance has opened a possibility to perform position resolved and/or in-situ studies on small volumes. The aim of this presentation is to demonstrate our recent activities in the application of synchrotron XRD at synchrotron sources ESRF, BESSY and Hasylab. Following topics will be presented: mechanical size effect in thin films characterized by high-temperature X-ray diffraction, mechanical size effect in small single-crystalline features analysed using in-situ μ Laue diffraction, the use of nano-beams to analyze microstructure, stresses and composition in graded nanostructures and 3D characterization of residual stresses in laser pulsed coated steel.