Understanding layers, nanowires and nanodots better on a lab multipurpose diffractometer

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Investigating the structural property of the engineered low dimensional materials such like layers, nanowires and nanodots is one of the basic tasks before proceeding for further studies. Conventional characterization techniques such as X-ray reflectivity, X-ray diffraction and reciprocal space mapping, etc., can provide a great deal of information to discriminate the polymorphism, determine composition and strain profiles, quantify thickness, density, surface and interface morphology, understand grain/crystalline size and distribution, estimate residual stress and degree of relaxation, know the preferred orientation for polycrystalline layer or epitaxial relationship for single crystal like high quality epitaxial layer.

However, due to certain properties of the grown material, classic investigation methods can meet its limit. For example, analyze the residual stress on a highly-textured layer is often challenged by the accuracy; understanding the surface structural ordering of the nanowires and nanodots needs a new approach. In this work, we present some alternative methods including X-ray reflectivity maps, ultra-fast reciprocal space map, multiple HKL-Chi tilt stress measurement and GISAXS that can tackle these challenges and provide a comprehensive insight towards structural characterizations.

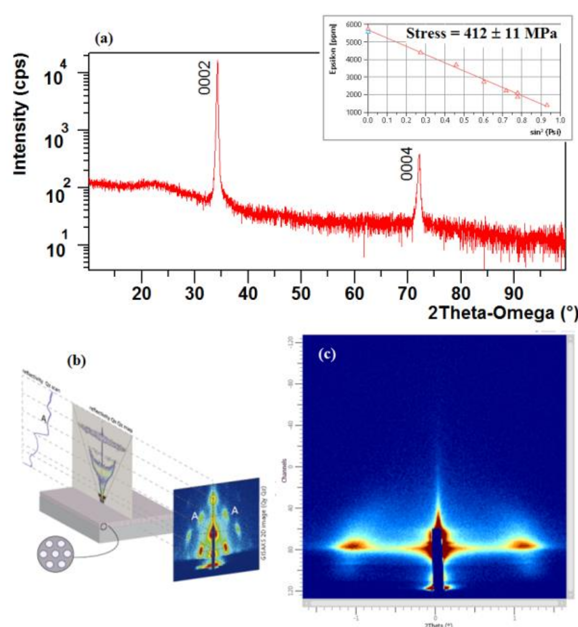

Fig. 1 (a) Stress result of an highly textured ZnO layer. (b)X-ray reflectivity map and GISAXS result of a nanoporous layer. (c) GISAXS image of a Co nanofiber sample.

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