MS40-P09 | Quantification of the strain relaxation processes in silicon nanowires arrays using combined X-ray diffraction analyses

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Semiconductor nanowires (NWs) gained an increased attention in the last years due to their improved physical properties, favourable for opto- and upwards bio-electronic applications. In particular, silicon based low dimensional systems stand out among the other systems since silicon represented the material for the solid state electronics that drove to novel ideas concerning both fundamental phenomena and application developments. In this paper, we investigate the strain evolution and emerged relaxation processes in highly dense arrays of silicon nanowires obtained through metal assisted chemical etching, focusing mainly on the morphology induced effects. To circumvent the issues related to the anisotropic distribution of the strain and structural defects along the nanowires, we proposed a non-destructive X-ray method that exploits the finite penetration depth nature of X-rays and also their ability to imagine the arrays morphology in terms of tilt and twist. Thus, if in most cases, the X-rays diffraction studies concerning the strain in nanowires systems employ synchrotron X-ray sources, our formalism enables us to build unambiguously the bending and torsion profiles and to gain a quantitative description of the relaxation processes in connection with their morphological features using laboratory X-ray diffraction experiments.