MS44-05 | Direct and Fourier Space Traveling: Multi-Dimensional Mapping of Lattice Strain and Tilt of a Suspended Silicon Nanowire in a Monolithic System

Dolabella, Simone (Empa- Swiss Federal Laboratories for Material Sciences and Technology, Dübendorf, CH)

Silicon nanowire based sensors such as micro and nano electrical mechanical systems (MEMS and NEMS) are well known in many fields of application due to their unique characteristics of flexibility and strength that emerge at the nano scale. In this work, we show a first study on this class of micro- and nano-fabricated silicon structures adopting the Scanning X-ray Diffraction Microscopy (SXDM) technique [1] by mapping the in-plane strain and tilt of a monolithic device structure comprised of suspended nanowires (NWs) and their monolithic pillars [2]. As a first step, we studied how the atomic structure of these new type of NWs is affected by the designed sample geometry including size and shape and critical steps of the fabrication process such as e-beam and DRIE. The combination of three-dimensional reciprocal space maps (3D-RSMs) with the distributions of in-plane strain and tilt plotted in two-dimensional real space images, allowed us to make a full analysis of the device structure. X-ray analysis performed on the (022) and (044) reflections show a very low level of lattice in-plane strain but a significant degree of lattice tilt.

[1] Chahine, G. A., Richard, M.-I., Homs-Regojo, R. A., Tran-Caliste, T. N., Carbone, D., Jacques, V. L. R., Grifone, R., Boesecke, P., Katzer, J., Costina, I., Djazouli, H., Schroeder, T. & Schulli, T. U. (2014). *Journal of Applied Crystallography* 47, 762-769.
[2] Tasdemir, Z., Peric, O., Sacchetto, D., Fantner, E. G., Leblebici, Y., & Alaca, B. E. (2018). IEEE Transactions on Nanotechnology 17, 6.