HAADF STEM block scanning strategy for the nanoscale measurement of strain in semiconductor FinFETs

HAADF HR-STEM imaging is a powerful tool to image atomic columns at the nanoscale and combined with image processing techniques like Geometric phase analysis [1] can provide strain information up to a spatial resolution of a unit cell. However, the HR-STEM images are often plagued by scanning distortions and sample drift due to thermal and mechanical instabilities. In this poster, a new scanning strategy is presented called “Block-scanning” [2] using a specialised custom scanning hardware, which scans in a block by block fashion. Each block consists of a patch of atomic resolution image (sub-image) of the sample which can be used to evaluate local strain in that region. This reduces the drift distortion which is prominent in a conventional raster scan as each block can be assumed to be near drift free given the much shorter recording time of an individual block. The method allows flexible tuning of spatial resolution and the specimen can be sampled at sparse locations, therefore allowing a wider and freely adjustable field of view while maintaining atomic resolution sampling within the sub-images. Each individual sub-images are fitted to a non-linear sinusoidal harmonic model and are treated independently from each other. We show the applicability of the technique on a 16 nm Si-Ge FinFET nano-device and compare the performance with the Bessel diffraction technique [3]. The technique approaches and is slightly lower than the precision obtained using the diffraction technique while it comes with an advantage of not requiring specialized diffraction cameras.

References

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