X-ray nanodiffraction in lithographically-defined semiconductor structures

The continued progress of computing technologies continually requires new concepts which improve the performance, efficiency, and scalability of Si-based devices. Uniaxial strain obtained using local stressors has become part of mainstream Si-based technology over the past few years, since uniaxial strain in Si improves its figures of merit in terms of microelectronic applications. In this work, top-down structures obtained by nanolithography are used as stressors for the creation of high deformation fields. Exploiting the fact that the Ge lattice parameter is 4.17% larger than that of Si, carefully shaped SiGe nanostructures can be used to locally induce uniaxial strain in Si. Nanofocused x-ray beams based on refractive or diffractive optics have recently become available at synchrotron light sources, allowing the distribution of strain within individual nanostructures to be measured directly.