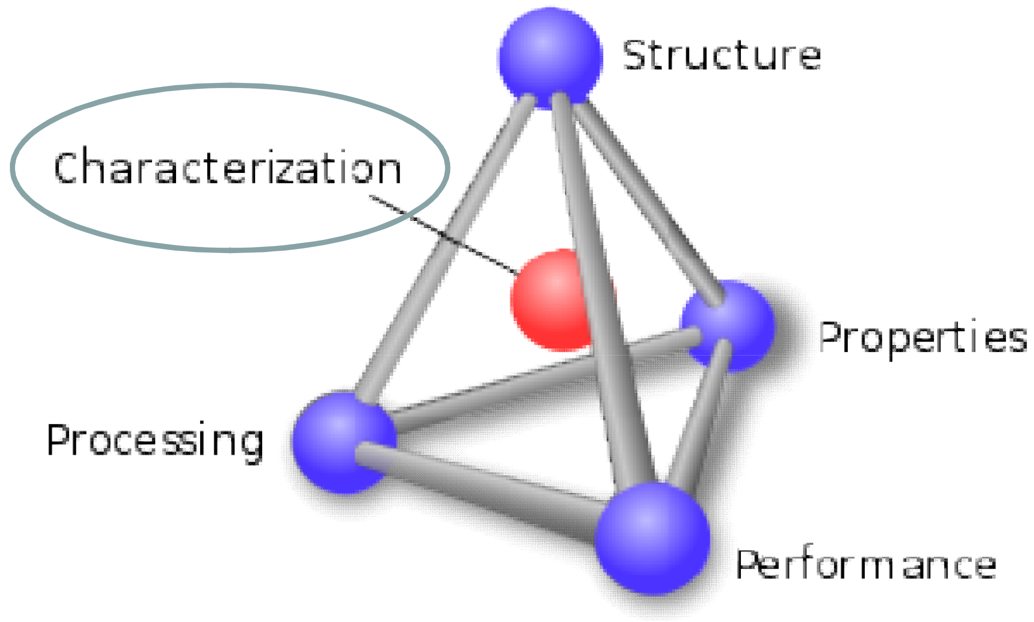
Ana M. Sanchez

Understanding the relation between properties, structure, processing , and performance.
Recognizing new design opportunities offered by materials selection.



My principal research aims are to develop characterization methodologies for the nanometre scale in advanced materials, to use these methodologies to advance the understanding of materials at a fundamental level, and so improve their properties, processing, and technology

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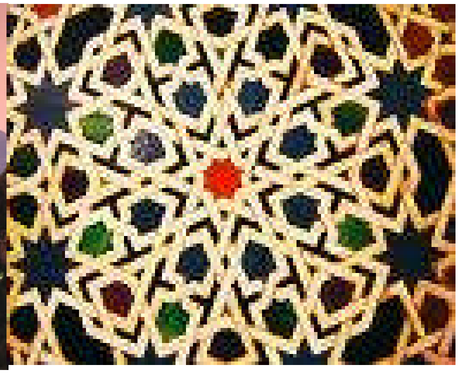
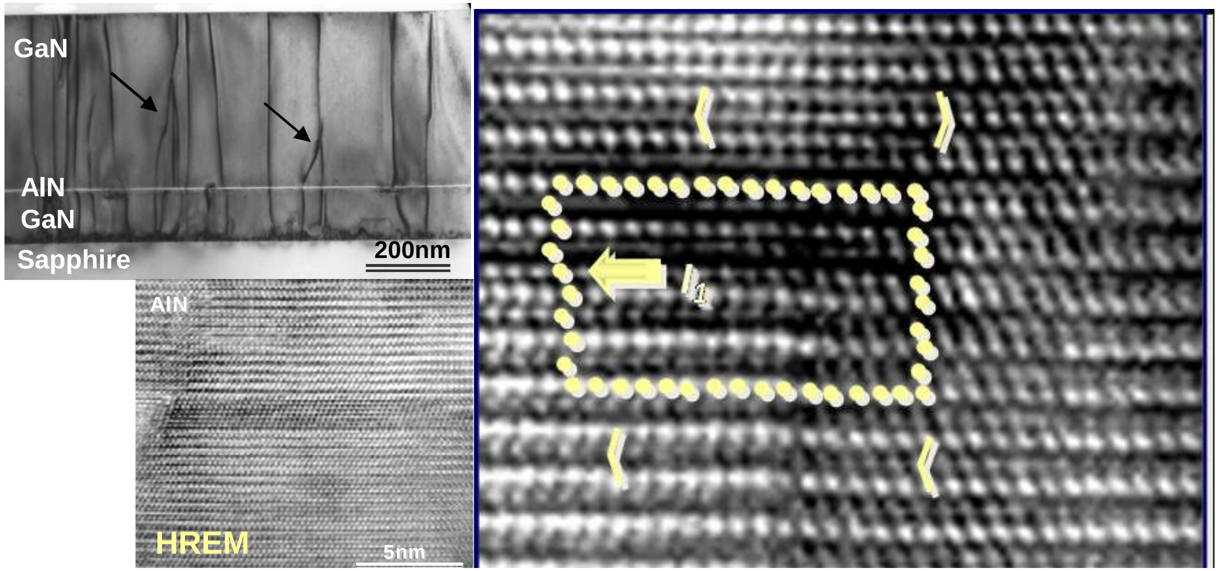


1996 Graduated in Physics-Chemistry (five years degree). University of Granada, SPAIN.



2001 Ph.D. in Science, with highly Honorific distinction. University of Cádiz, SPAIN.

1998 Assistant Professor, Department of Materials Science and Metallurgical Engineering and Inorganic Chemistry. University of Cádiz, Spain.

2002/2003 Post-doc at Centre National de la Recherche Scientifique. Institut des Sciences de la Matière et du Rayonnement. Caen, France.

2**003/2005** Post-doc/Research Fellow at Materials Science department in Liverpool University, England.

2005/2009 Researcher at Cadiz University, supported by individual contract. These 3 (+2) year contracts are awarded on a competitive, peer-reviewed basis.

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September 2009 -

Science City Senior Research Fellow
Physics Department
Warwick University

Honorary Research Fellow
School of Physics and Astronomy
Birmingham University

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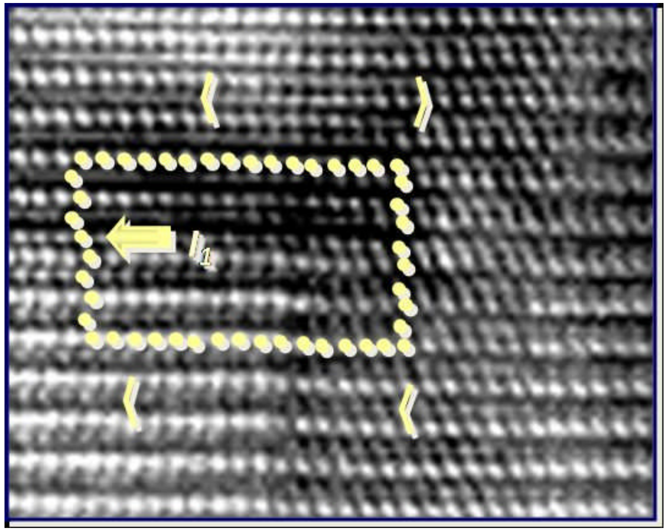
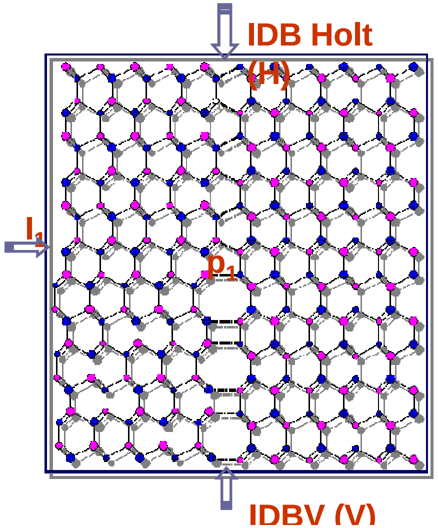
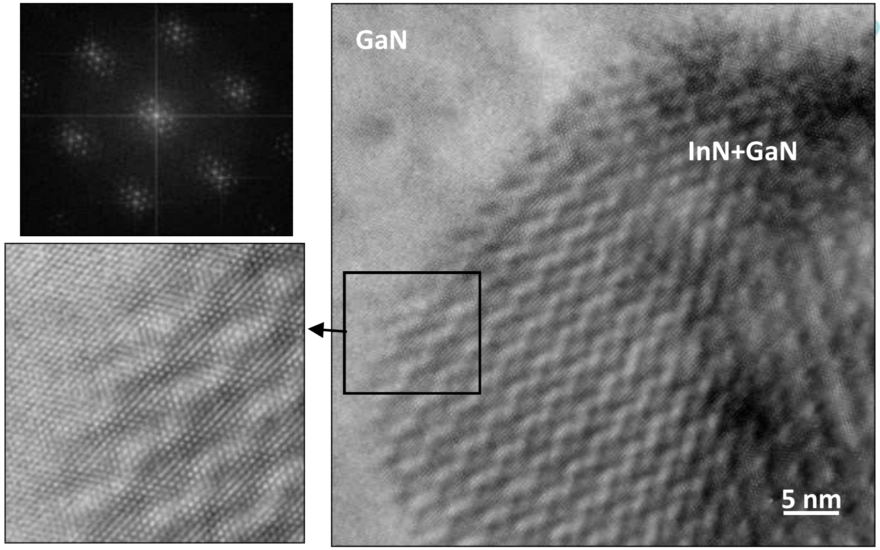
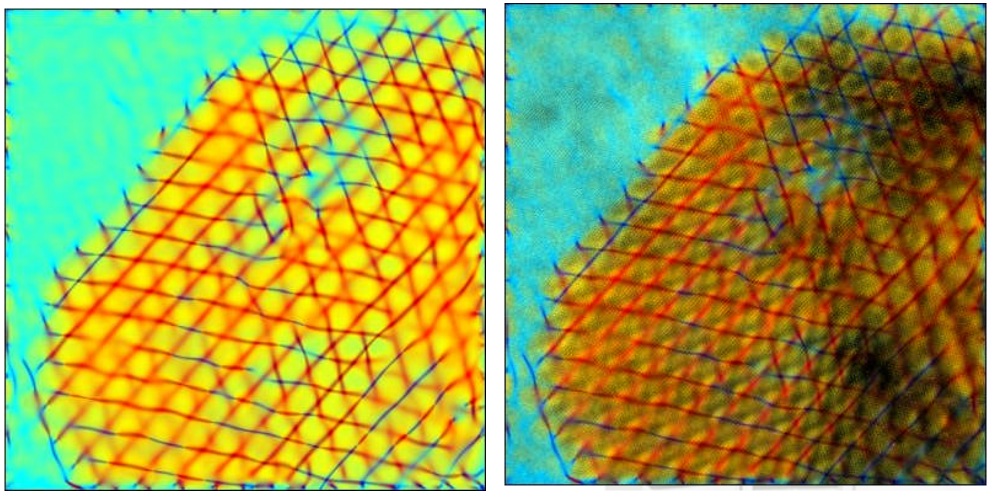
Advanced Materials: **III-N semiconductor**





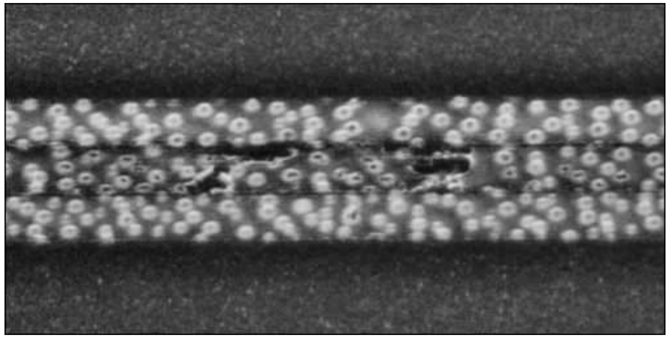
Pinholes formation in GaN/AlN/Si(111) MBE layers from steps at the substrate surface. Appl. Phys. Lett. **86** (2005) 011917.
Inversion domains and pinholes in GaN grown over Si(111). Appl. Phys. Lett. **82** (2003) 4471.

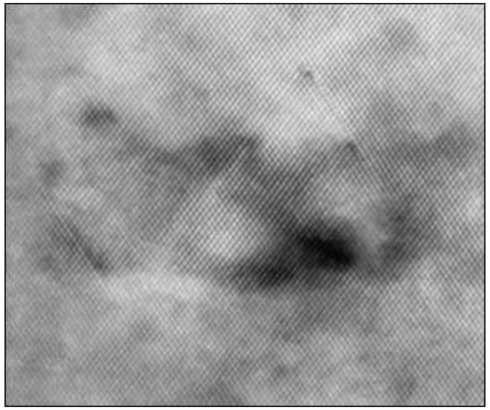


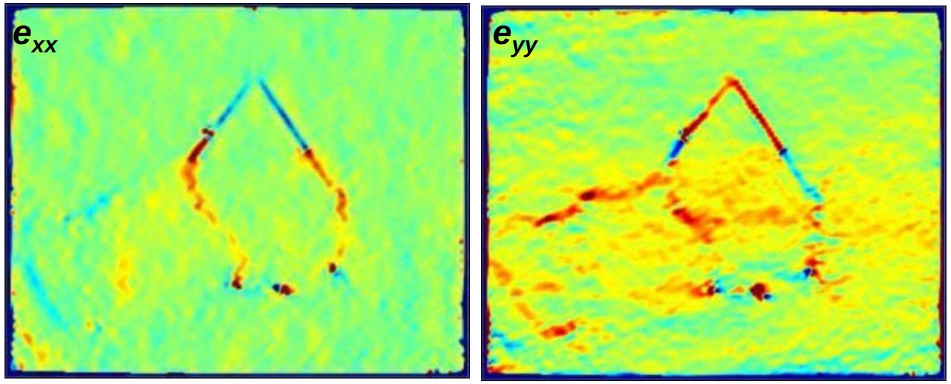


Strain mapping at atomic scale in high mismatched heterointerfaces. Adv. Funct. Mat. **17** (2007) 2588.
Misfit relaxation of InN quantum-dots: the effect of the GaN capping layer. Appl. Phys. Lett. **88** (2006) 151913.
Nucleation of InN quantum dots on GaN by metalorganic vapor phase epitaxy. Appl. Phys. Lett. **87** (2005) 263104.

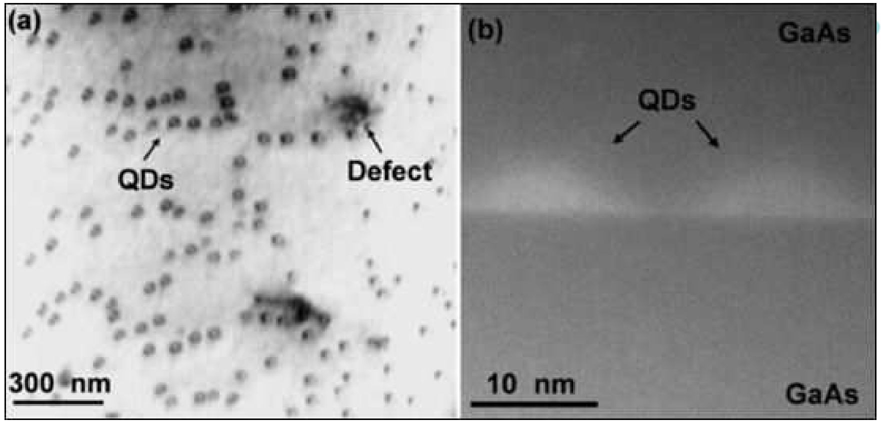
Advanced Materials: **III-V semiconductor**

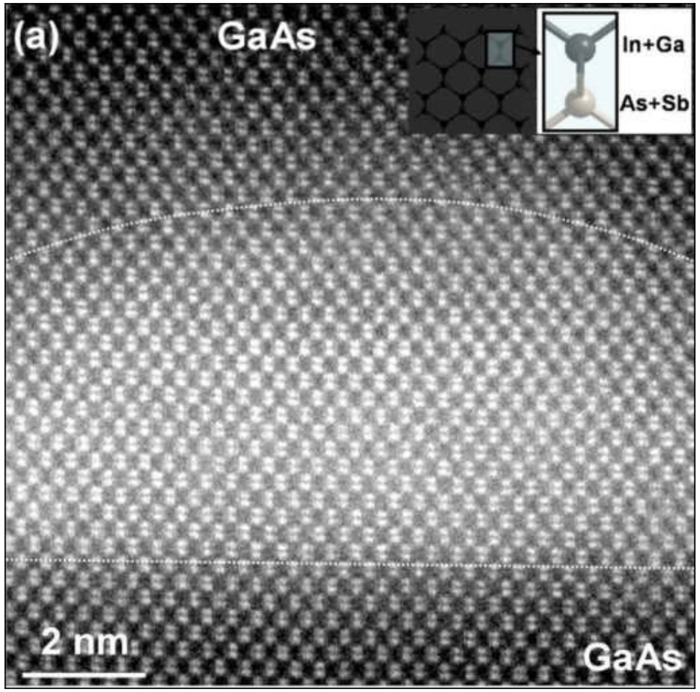






Quantum dots in strained layers –preventing relaxation through the precipitate hardening effect. J. Appl. Phys. (2008) In press .
Structural analysis of life tested 1.3μm quantum dot lasers.
J. Appl. Phys. **103** (2008) 014913.





Incorporation of Sb in InAs/GaAs quantum dots. Appl. Phys. Lett. **91** (2007) 263105.

Advanced Materials: **Piezoelectric ceramics**

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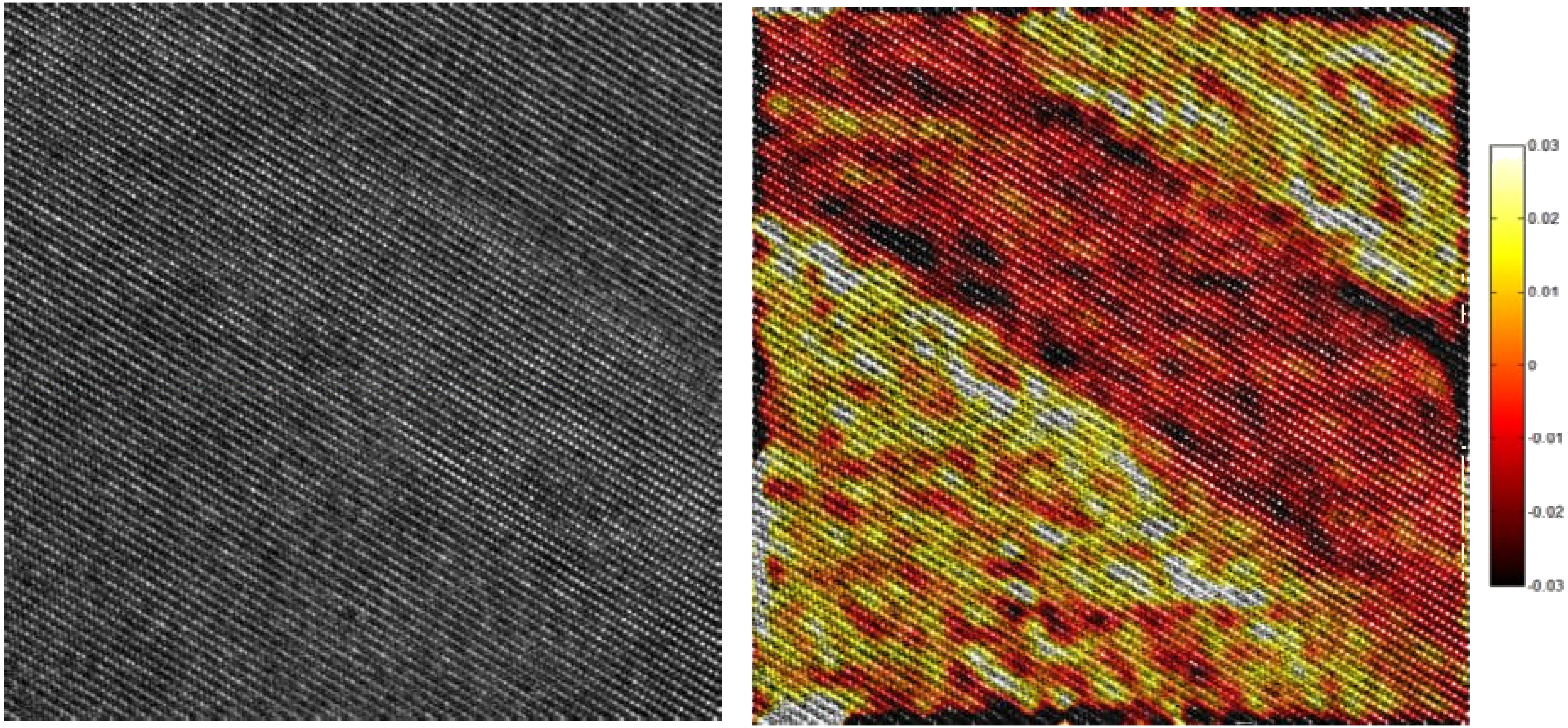
Quantitative deformation mapping applied to $NaBiTiO_3$ piezoelectric ceramic



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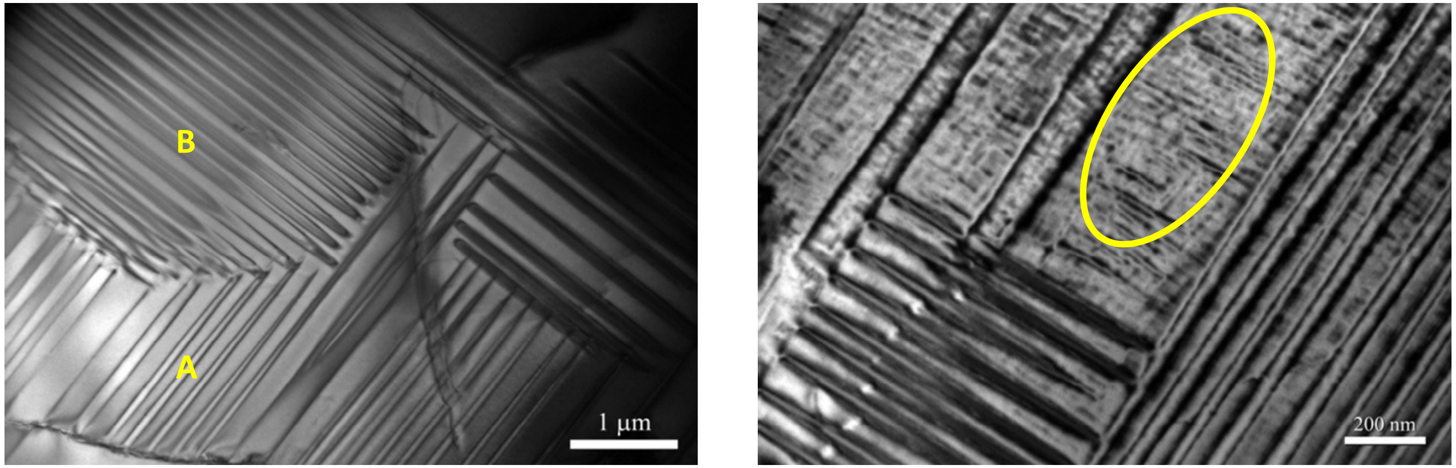
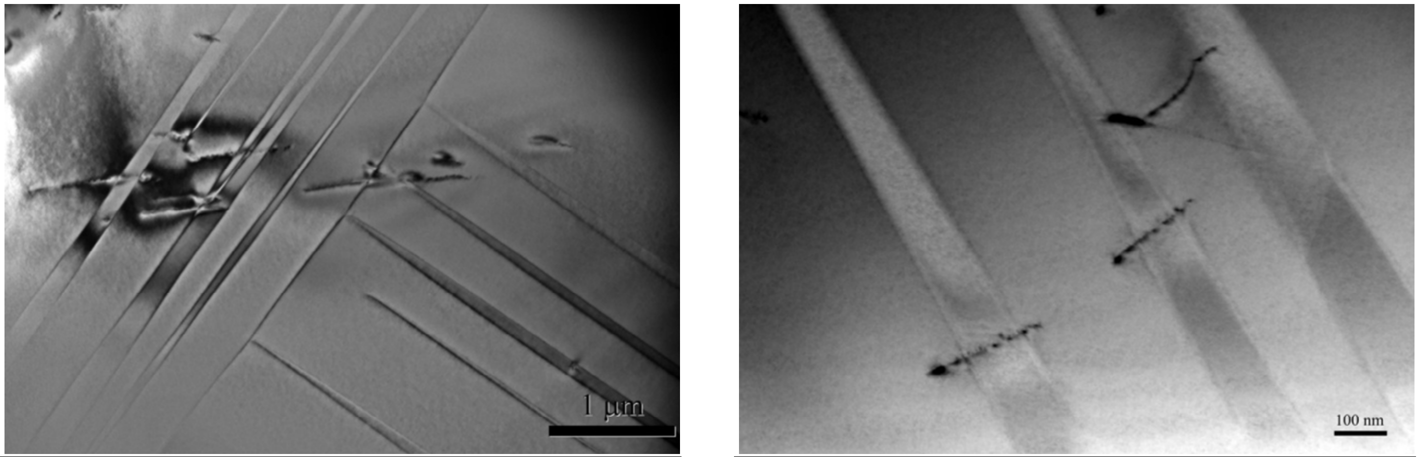
Advanced Materials: **Piezoelectric ceramics**

Analysis of ferroelectric domains in $BaTiO_3$

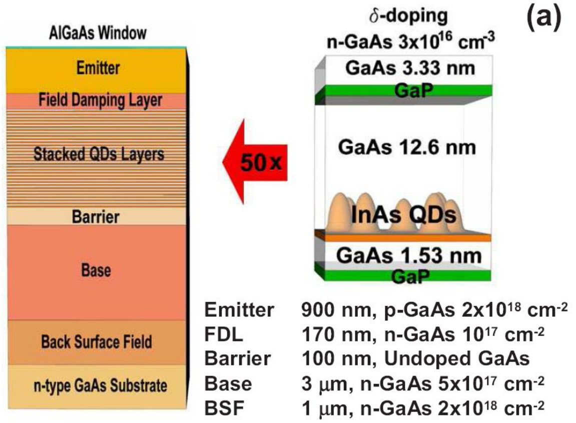


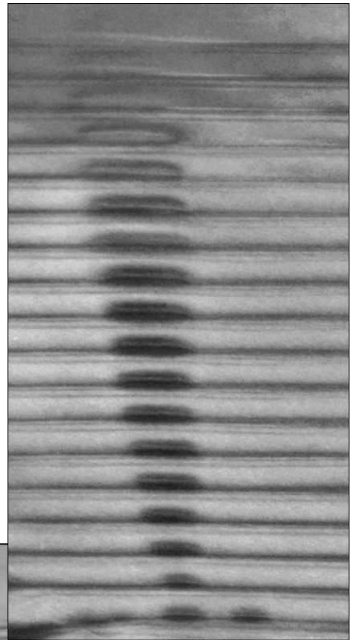
Bright field TEM micrographs close to the <001> zone axis. (a) Ferroelectric domain structure with domain boundaries lying in {110} planes (b) Ferroelectric domains plus tweed structure.

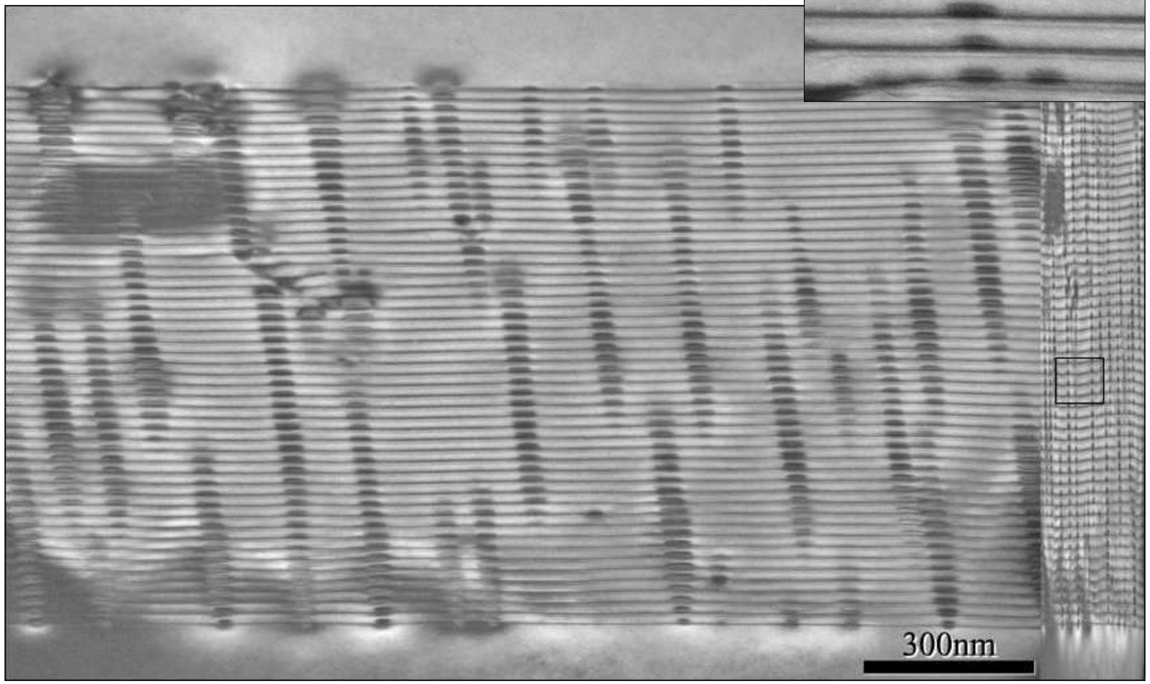


Bright field TEM micrographs showing ferroelectric domains and dislocations

Energy Futures: **Solar Cell**







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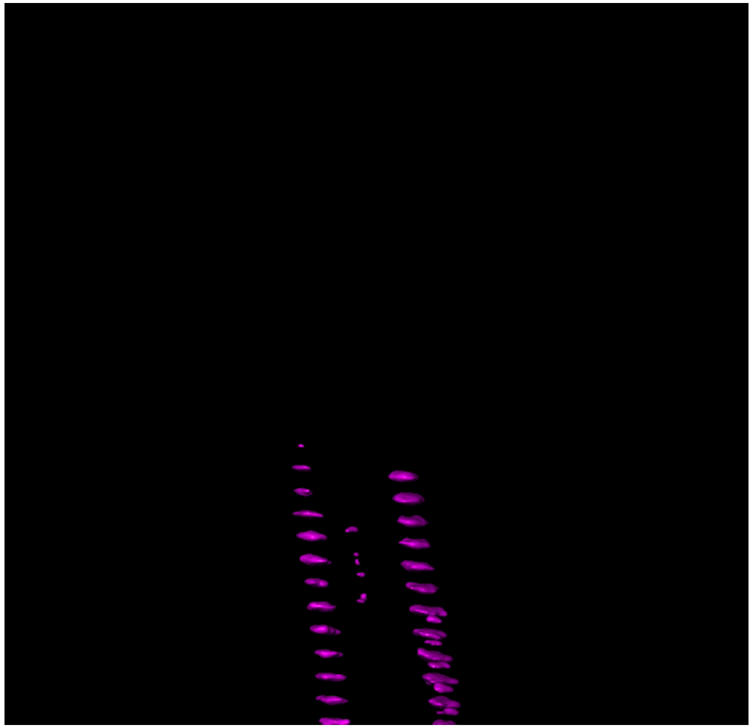

Carrier recombination effects in strain compensated quantum dot stacks embedded in solar cell.
Appl. *Phys*. Lett. **93** (2008) 123114.

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Devices: **III-V quantum dot lasers**

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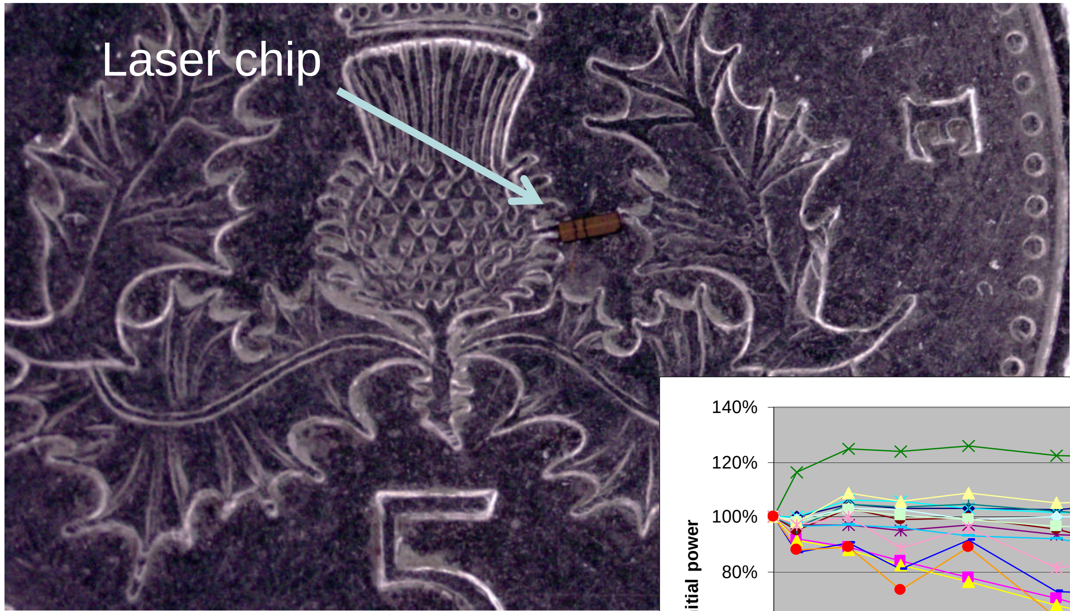

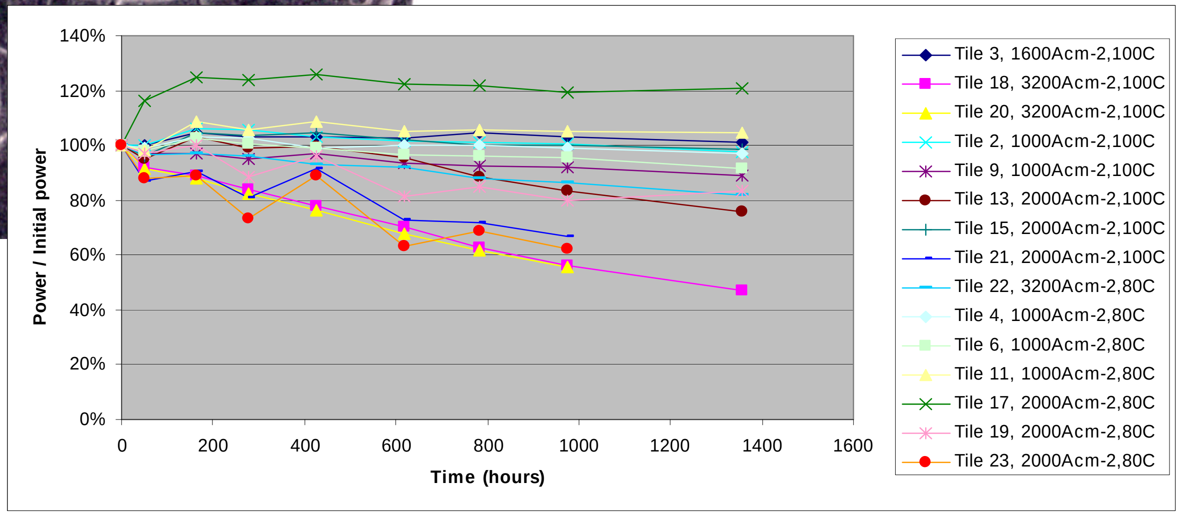

- After an initial change all devices show continuous degradation
- Typical behaviour for laser diodes but degradation rate is very high for some devices (high temperature + high current density)
- Highest degrading device used for TEM study

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Devices: **III-V quantum dot lasers**

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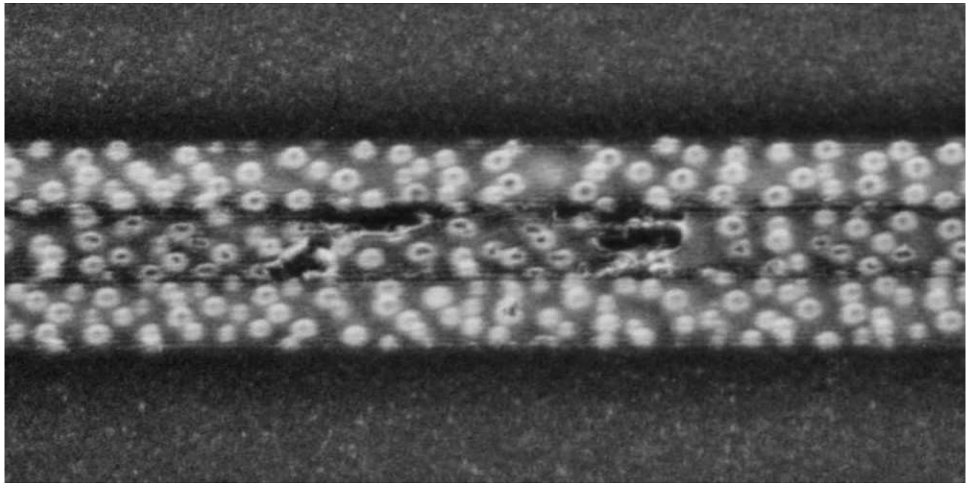
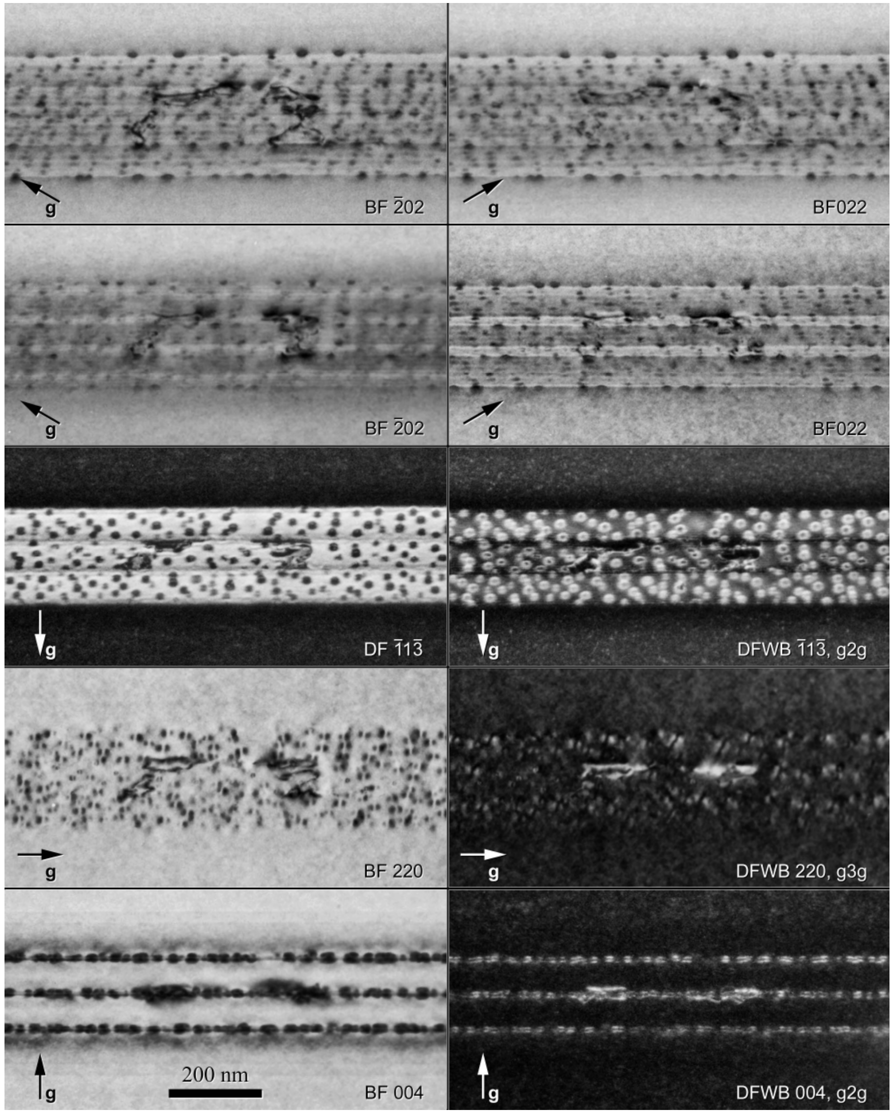


Image courtesy of R. Beanland



- Device #18 sectioned parallel to the ridge
- The dark spots are dislocation loops which are growing in the interfacial plane
- The loop lies between the quantum dots
- Probably confined to the $In_xGa_{1-x}As$ well layer
- Structure is consistent with pinning of the loop by the dots, inhibiting growth
- Identification of Burgers vector not straightforward due to strain contrast from dots

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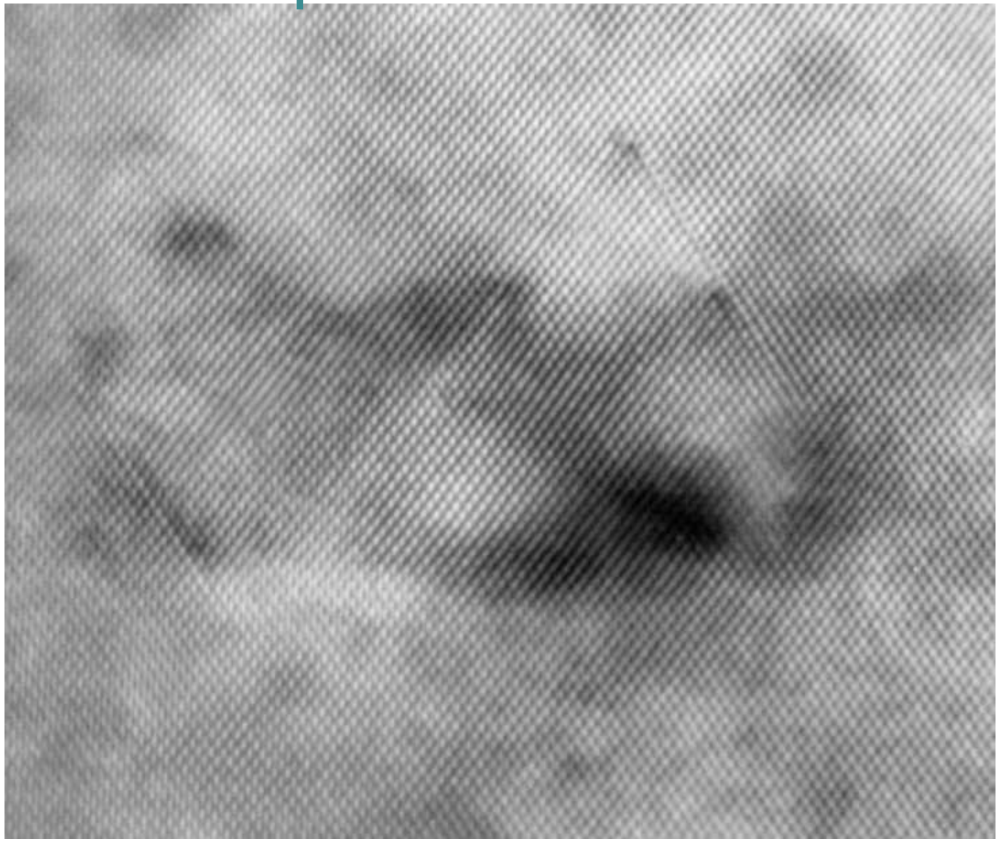
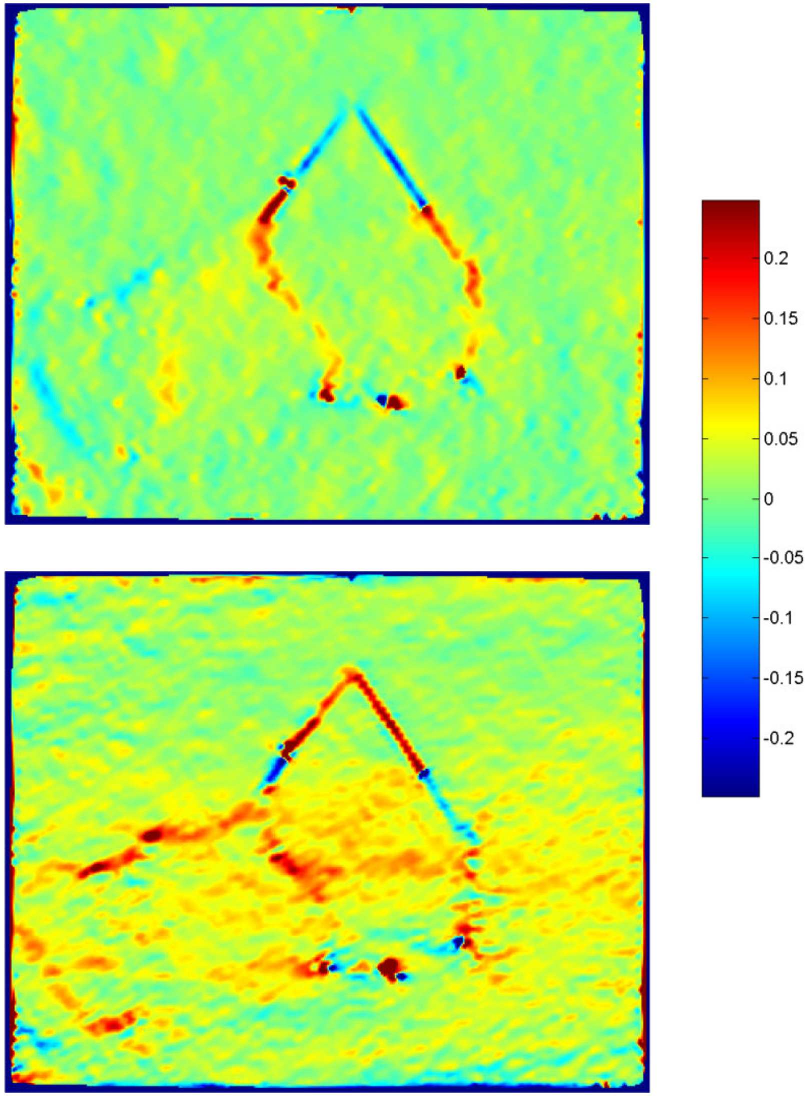
Devices: III-V quantum dot lasers



Multi-beam imaging allows high-resolution images to be formed. This images the projected potential of the crystal; looking along a crystallographic axis shows the position of atom columns. Accurate measurement of the position of each dot can give the displacement field and atomic-scale strain analysis.

Quantum dots in strained layers –preventing relaxation through the precipitate hardening effect. J. Appl. Phys. **104** (2008) 123502

Structural analysis of life tested 1.3μm quantum dot lasers. J. Appl. Phys. **103** (2008) 014913.



Techniques: **3D Characterization**

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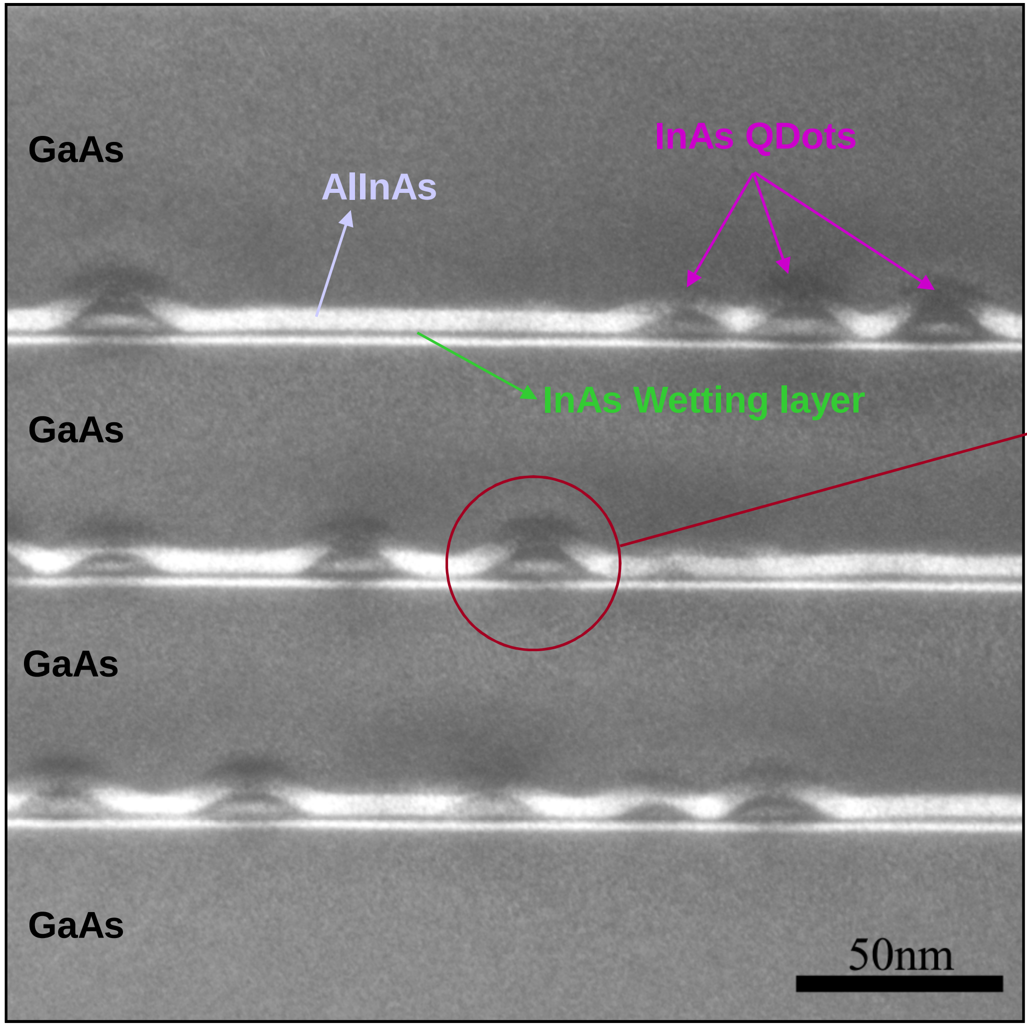

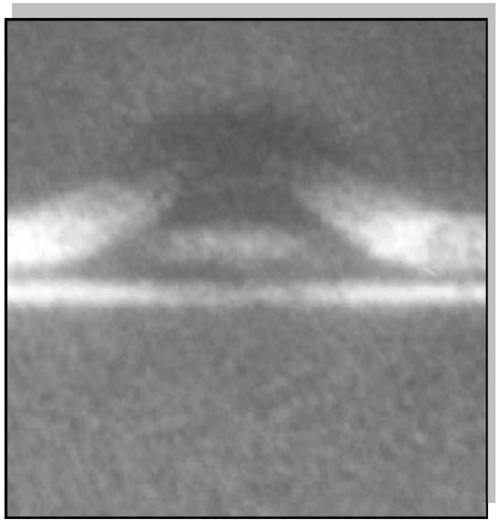

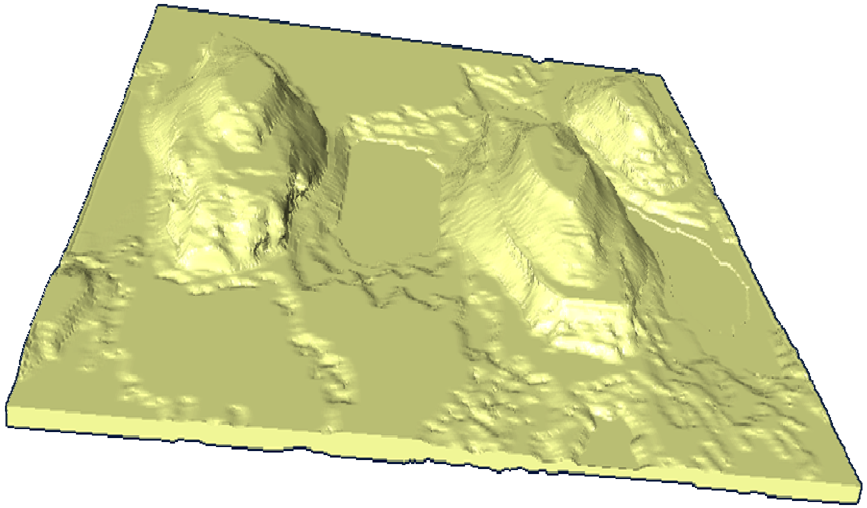

Electron Tomography of III-V Quantum Dots Using Dark Field 002 Imaging Conditions. J. Microsc. **In press** (2009)

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Techniques: **3D Characterization**

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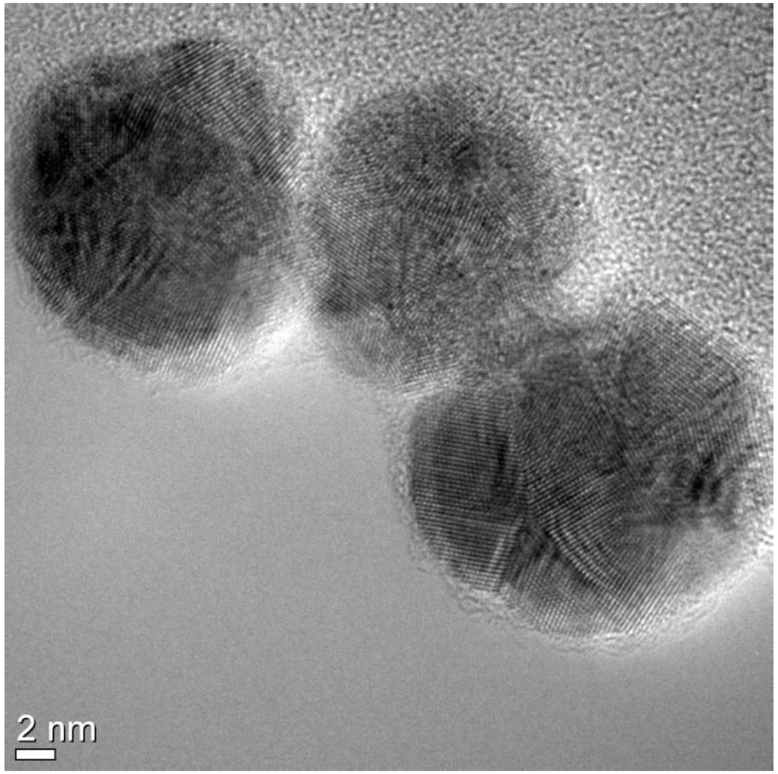
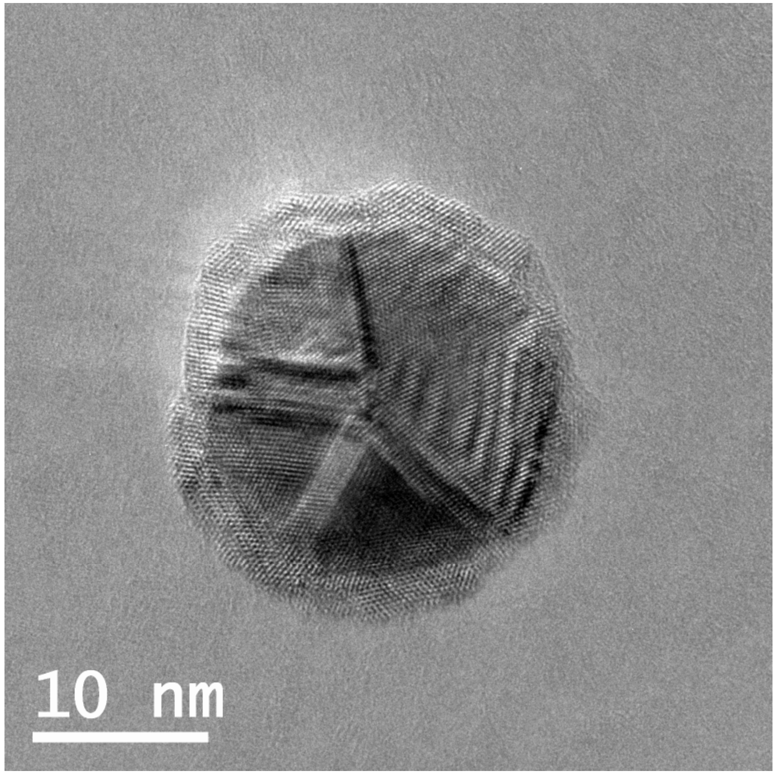
Pd(20) Au(80) core-shell nano-particles, FEI Titan with image Cs-corrector @ 300kV





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Techniques: **3D Characterization**

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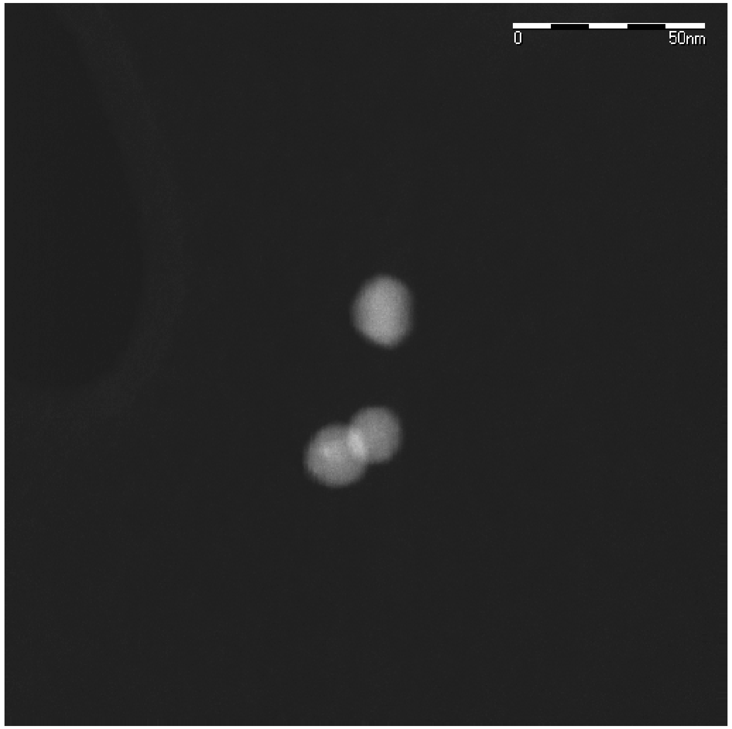
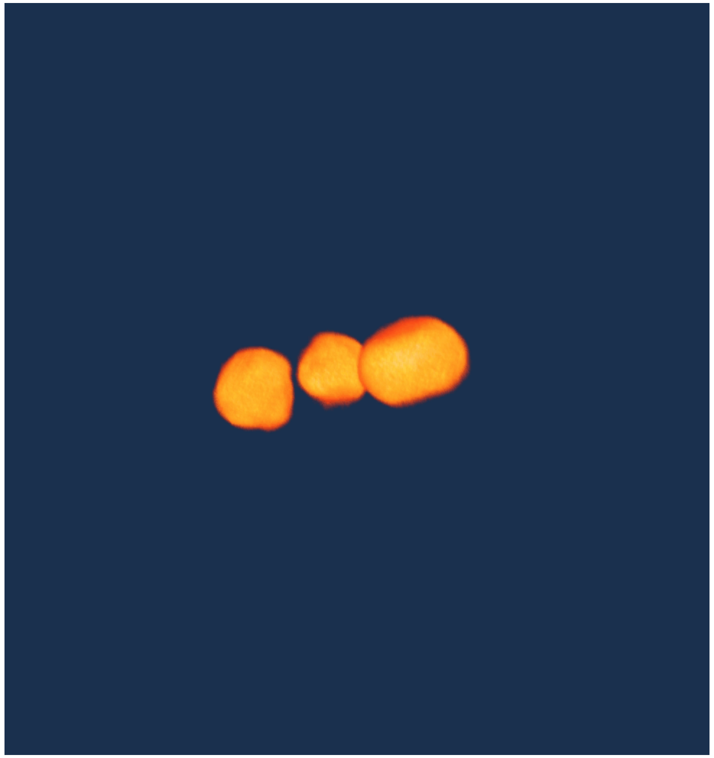


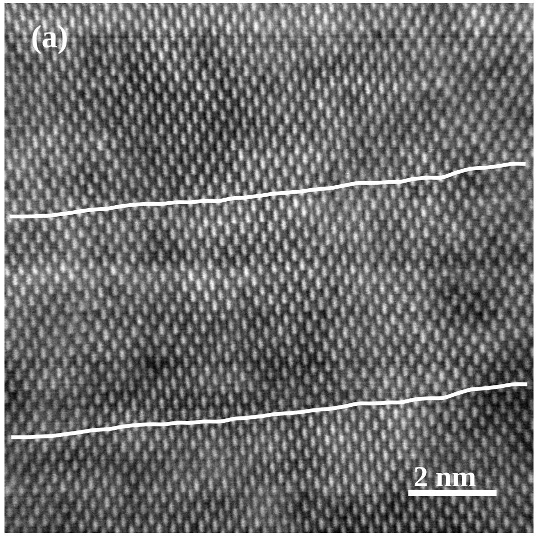
Detailed 3D information can be obtained from a series of images using HAADF-STEM imaging conditions (mass-thickness contrast).

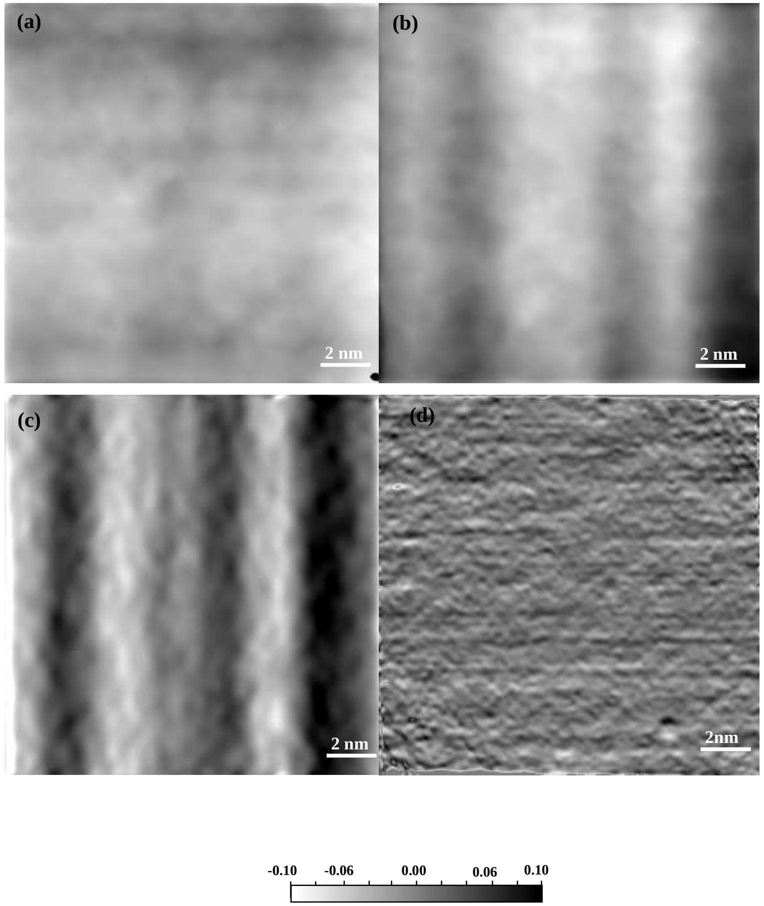


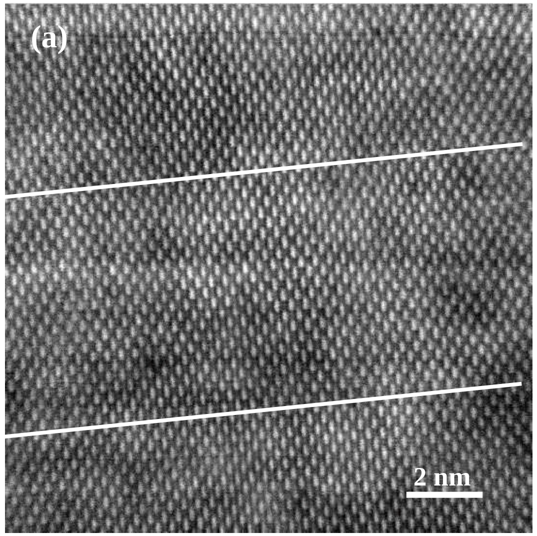
Reconstructed surfaces of the nanoparticles. The 3D dataset can be interrogated quantitatively (e.g. volumes, surface curvature, faceting etc.)

Techniques: Quantitative HREM and STEM

Quantitative mapping applied to aberration corrected HAADF images







An approach to the systematic distortion correction in aberration-corrected HAADF images. J. Microsc. **221** (2006) 1.
Quantitative Strain Mapping Applied to Aberration Corrected HAADF images. Microsc. And Microanal. **12** (2006) 285.

Techniques: Quantitative HREM and STEM

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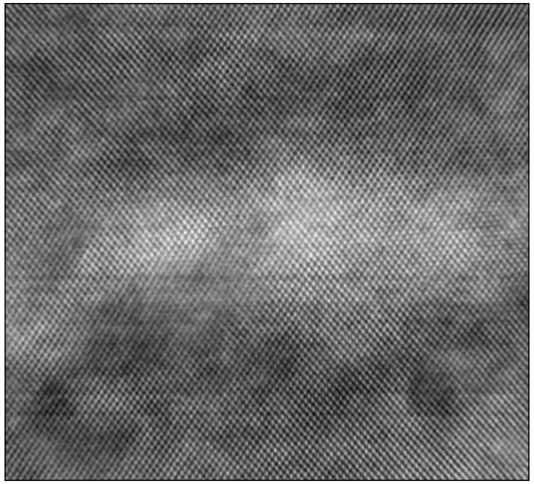
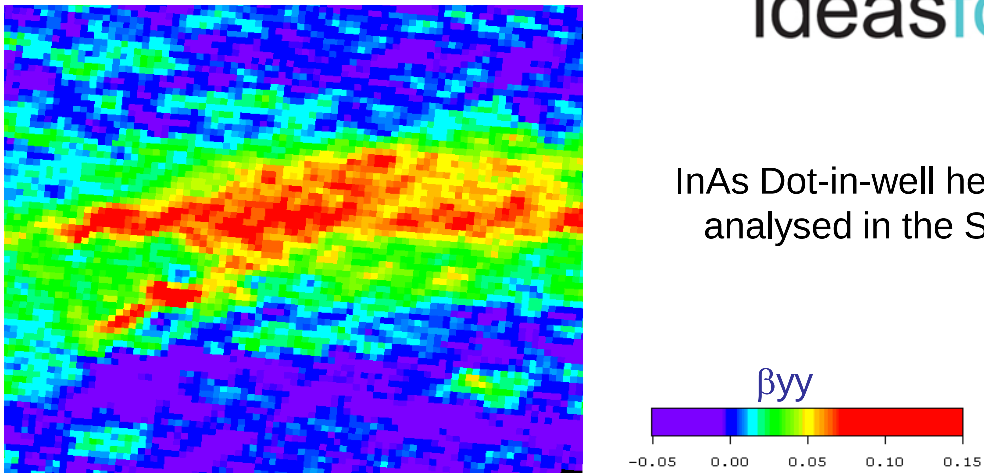
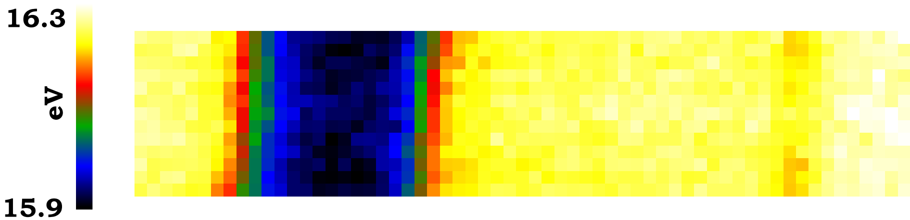


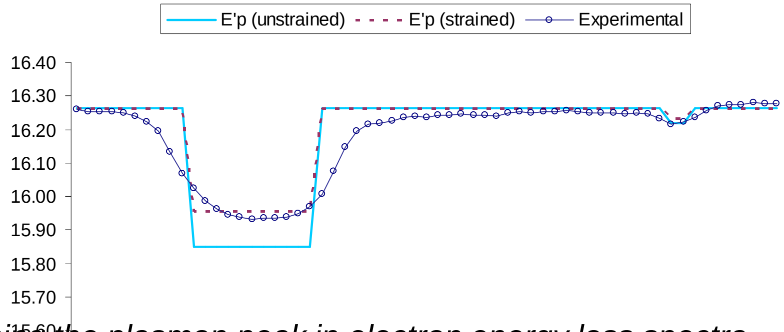


InAs Dot-in-well heterostructure analysed in the SuperSTEM

An approach to the systematic distortion correction in aberration-corrected HAADF images. J. Microsc. **221** (2006) 1.
Quantitative Strain Mapping Applied to Aberration Corrected HAADF images. Microsc. And Microanal. **12** (2006) 285.

Techniques: Nanometric measurement using bulk plasmon peak in EELS





Nanometric-scale strain measurements in semiconductors: an approach using the plasmon peak in electron energy loss spectra. Appl. Phys. Lett.**88** (2006) 051917.
Mapping quantum dot-in-well structures on the nanoscale using the plamon peak in electron energy loss spectra. Phys. Rev. B **72** (2005) 075339.

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Research Interests

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- Structural characterization of semiconductor materials using electron microscopy techniques: high resolution TEM, conventional TEM, STEM and associated techniques.
- Developing new analysis techniques through the use of the latest image and spectrum processing techniques (e.g. measurement of strain, electronic/optical properties).
- Low-loss electron energy loss spectroscopy, in particular plasmon excitations.
- Thin films and nanostructures, particularly semiconductors such as GaN, InN, SiC, GaAs, InAs, GaSb, and related materials.
- 3-D characterization at the nanometre scale.
- Polarization and phase mapping at the nanometre scale in ceramic materials.
- Microstructural phase transformations as a function of temperature and applied electric field.
- Domain switching in ferroelectric thin films.

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