

TIMOTHY J. PENNYCOOK

Curriculum vitae

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h-index: 37 i10-index: 58 Citations: 7575

August, 2022

RESEARCH INTERESTS

My research focuses on the development and application of advanced techniques in scanning transmission electron microscopy (STEM), currently with a particular emphasis on ptychography and 4D STEM.

ACADEMIC CAREER

- 2019–present **Assistant Professor**, University of Antwerp, Belgium
ERC Principle Investigator of the project High Definition Electron Microscopy (HDEM)
- 2017–2019 **Scientist**, Max-Planck-Institute for Solid State Research, Stuttgart, Germany
- 2015–2017 **Marie Skłodowska-Curie Fellow**, Faculty of Physics, University of Vienna, Austria
- 2014–2015 **Postdoctoral Scientist**, Faculty of Physics, University of Vienna, Austria
- 2012–2014 **Staff Scientist**, SuperSTEM Laboratory, UK
Postdoctoral Scientist, Department of Materials, University of Oxford, UK

EDUCATION

- 2006–2012 **Ph.D.** in physics at Vanderbilt University and Oak Ridge National Laboratory, USA
Understanding Materials through Scanning Transmission Electron Microscopy & Density Functional Theory
Advisor: Prof. Sokrates T. Pantelides
- 2002 – 2006 **B.A.** in Physics at Reed College, Portland Oregon, USA
Thesis: Three-state L-configuration electromagnetically induced transparency
Advisor: Prof. Danielle A. Braje
- 2004 – 2005 **Research internship** in The Scanning Transmission Electron Microscopy Group, Oak Ridge National Laboratory, USA
Advisor: Dr. Maria Varela

GRANTS

- 2022 **Universiteit Antwerpen Bijzonder Onderzoeksfonds** (210,000 Euros)
- 2021 **Fonds Wetenschappelijk Onderzoek Fundamental Research Project** (461,000 Euros)
- 2020 **Universiteit Antwerpen Bijzonder Onderzoeksfonds** (210,000 Euros)
- 2019 **ERC Starting grant** (1,500,000 Euros)
- 2015 **EC Marie Skłodowska-Curie Fellowship** (166,157 Euros)

TEACHING

- 2020 – present **Advanced Electron Microscopy** Masters' course in electron microscopy
- 2020 – present **Projects in Microscopy and Spectroscopy** Masters' research projects in electron microscopy and spectroscopy

AWARDS

- 2018 **The Albert Crewe Award, Major award of the Microscopy Society of America**, their highest for early career scientists working in the physical sciences. [For press release click here.](#)
- 2015 **European Microscopy Society Outstanding Paper Award** in the Materials Sciences category for *Imaging screw dislocations at atomic resolution by aberration-corrected electron optical sectioning*, Nature Communications 6, 7266 (2015)
- 2014 **Birks Award for Best Contributed Paper from Microscopy & Microanalysis 2013** for *Depth Sensitive Atomic Resolution Spectroscopy and Imaging of Highly Strained YSZ/STO*
- Microscopy & Microanalysis Postdoctoral Award** for *Optical Sectioning with Atomic Resolution Spectroscopy*
- Second Place, 2014 Microscience and Microscopy Congress Poster Competition** for *Maximum efficiency phase contrast imaging in scanning transmission electron microscopy*
- 2012 **Best Oral Presentation, YUCOMAT conference** for *White Light Emission from Fluctuating Nanoclusters*
- 2010 **International Federation of Societies for Microscopy Scholarship** for *Strain-Enhanced Ionic Conductivity*
- Microscopy Society of America, Presidential Scholar Award** for *Strain-Enhanced Ionic Conductivity*
- 2005 **Microscopy and Microanalysis Graduate Student Poster Competition** Second Place, for *Spatial Resolution of Spectroscopic Imaging in Complex Oxides*
- Microscopy Society of America Undergraduate Research Scholarship** for *Atomic Scale Studies of Manganite Grain Boundaries with Colossal Magnetoresistance*

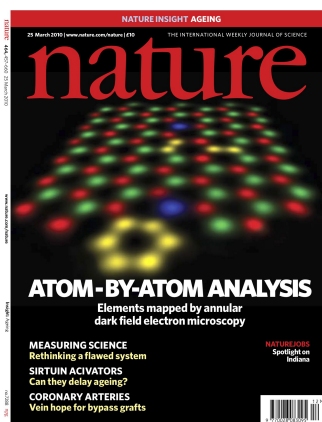
RECOGNITIONS

- 2022 **Applied Physics Letters Editor's Pick**
C. Gao *et al.* "Overcoming contrast reversals in focused probe ptychography of thick materials: An optimal pipeline for efficiently determining local atomic structure in materials science". Applied Physics Letters 121, 081906 (2022).
- 2017 **Nature Nanotechnology Research Highlight**
R. Mirzayev *et al.* "Buckyball sandwiches". Science Advances 3, e1700176 (2017).
- 2014 **APS Physics Featured in Physics & IEEE Spectrum News Release**
C. Li *et al.* "Grain-Boundary-Enhanced Carrier Collection in CdTe Solar Cells". Physical Review Letters 112, 15 (2014).
- Nature Materials News & Views**
K. R. Paton *et al.* "Scalable production of large quantities of defect-free few-layer graphene by shear exfoliation in liquids". Nature Materials 13, (2014), p. 624.

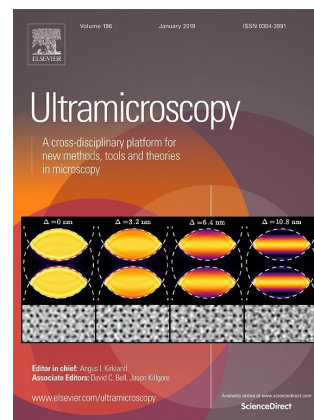
PEER REVIEW

since 2022	<i>Microscopy and Microanalysis</i> (Cambridge University Press)
since 2021	<i>Physical Review Research</i> (American Physical Society)
since 2020	<i>Nature</i> (Nature Group)
since 2017	<i>Microscopy</i> (Oxford University Press)
since 2016	<i>Nature Communications</i> (Nature Group)
since 2016	<i>Journal of Microscopy</i> (The Royal Microscopical Society)
since 2015	<i>Nanoletters</i> (American Chemical Society Publications)
since 2013	<i>Ultramicroscopy</i> (Elsevier)

JOURNAL COVERS



Nature 464 (2010)
design by T. J. Pennycook



Ultramicroscopy 196 (2019)
figure by T. J. Pennycook

TEN SELECTED PUBLICATIONS

- 2021 H. S. Wang, L. Chen, K. Elibol, L. He, H. Wang, C. Chen, C. Jiang, C. Li, T. Wu, C. X. Cong, T. J. Pennycook, G. Argentero, D. Zhang, K. Watanabe, T. Taniguchi, W. Wei, Q. Yuan, J. C. Meyer and X. Xie. **“Towards Chirality Control of Graphene Nanoribbons Embedded in Hexagonal Boron Nitride”**. *Nature Materials* 20 (2021), p. 202.
Citations: 50
Edge-specific fabrication of graphene nanoribbons embedded in h-BN.
- D. Jannis, C. Hofer, C. Gao, X. Xie, A. Béch e, T. J. Pennycook and J. Verbeeck. **“Event Driven 4D STEM Acquisition With a Timepix3 Detector: Microsecond Dwell Time and Faster Scans for High Precision and Low Dose applications”**. *Ultramicroscopy* 233 (2021), p. 113423.
Citations: 13
First 4D STEM unhindered by the speed of the camera.
- 2019 T. J. Pennycook, G. T. Martinez, P. D. Nellist, J. C. Meyer **“High Dose Efficiency Atomic Resolution Imaging via Electron Ptychography”**. *Ultramicroscopy* 196 (2019), p. 131.
Citations: 28
Superior low dose performance over conventional HRTEM with ptychography.
- 2017 T. J. Pennycook, H. Yang, L. Jones, M. Cabero, A. Rivera-Calzada, C. Leon, M. Varela, J. San-

tamaria, P. D. Nellist, “3D Elemental Mapping with Nanometer Scale Depth Resolution via Electron Optical Sectioning”. *Ultramicroscopy* 174, p. 27.

Citations: 7

First spectroscopic optical sectioning with nanometer scale depth resolution.

2015 T. J. Pennycook, H. Yang, L. Jones, A. R. Lupini, M. F. Murfitt and P. D. Nellist, “Efficient Phase Contrast Imaging in STEM Using a Pixelated Detector. Part I: Experimental Demonstration at Atomic Resolution”. *Ultramicroscopy* 151, (2015), p. 160.

Citations: 197

Direct ptychography method for maximum efficiency imaging in STEM.

2014 K. R. Paton, E. Varrla, C. Backes, R. J. Smith, U. Khan, A. O’Neill, C. Boland, M. Lotya, O. M. Istrate, P. King, T. Higgins, S. Barwich, P. May, P. Puczkarski, I. Ahmed, M. Moebius, H. Pettersson, E. Long, J. Coelho, S. E. O’Brien, E. K. McGuire, B. M. Sanchez, G. S. Duesberg, N. McEvoy, T. J. Pennycook, C. Downing, A. Crossley, V. Nicolosi and J. N. Coleman. “Scalable Production of Large Quantities of Defect-Free Few-Layer Graphene by Shear Exfoliation in Liquids”. *Nature Materials* 13, (2014), p. 624.

Citations: 2123

Simple scalable production of large amounts of graphene.

C. Li, Y. Wu, J. Poplawsky, T. J. Pennycook, N. Paudel, W. Yin, S. J. Haigh, M. P. Oxley, A. R. Lupini, M. Al-Jassim, S. J. Pennycook and Y. Yan. “Grain-Boundary-Enhanced Carrier Collection in CdTe Solar Cells”. *Physical Review Letters* 112 (2014), p. 156103.

Citations: 298

Physics behind the efficiency of CdTe solar cells.

2012 T. J. Pennycook, J. R. McBride, S. J. Rosenthal, S. T. Pantelides and S. J. Pennycook, “Dynamic Fluctuations in Ultrasmall Nanocrystals induce white light emission”. *Nano Letters* 12, 3038 (2012), p. 571.

Citations: 102

Physics of white light emission from individual nanoclusters.

2010 O. L. Krivanek, M. F. Chisholm, V. Nicolosi, T. J. Pennycook, G. J. Corbin, N. Dellby, M. F. Murfitt, C. S. Own, Z. S. Szilagy, M. P. Oxley, S. T. Pantelides and S. J. Pennycook. “Atom-by-Atom Structural and Chemical Analysis by Annular Dark-Field Electron Microscopy”. *Nature* 464 (2010), p. 571.

Citations: 1249

Locating and identifying individual atoms in 2D materials.

T. J. Pennycook, M. J. Beck, K. Varga, M. Varela, S. J. Pennycook and S. T. Pantelides. “Origin of Colossal Ionic Conductivity in Oxide Multilayers: Interface Induced Sublattice Disorder”. *Physical Review Letters* 104 (2010), p. 115901.

Citations: 137

Physics of the eight orders of magnitude increase in the ionic conductivity of multilayer YSZ.

INVITED TALKS

2022 1. Materials Research Society Fall Meeting: “Fast and focused 4D STEM: an optimal pipeline for atomic resolution imaging in materials science”

2020 2. Faculty of Science Research Day, University of Antwerp: “Seeing how atoms build materials”

- 2019
3. Frontiers of Electron Microscopy in Materials Science (FEMMS 2019) Conference: “From dynamics to high dose efficiency imaging in STEM”
 4. Microscopy & Microanalysis (M&M 2019) Conference: “Efficient phase contrast imaging via electron ptychography, a tutorial
 5. Royal Belgian Society for Microscopy (RBSM) Meeting: “Highly efficient phase contrast imaging in STEM with electron ptychography”
 6. EMAT Summer School on TEM, University of Antwerp: “Electron ptychography”
 7. University of Vienna Department of Physics Seminar: “Highly efficient phase contrast imaging in STEM with electron ptychography”
- 2018
8. 3rd Sino-German Symposium on Advanced Electron Microscopy and Spectroscopy, Beijing: “High-definition electron microscopy: Greater clarity via multidimensionality”
 9. EMAT Seminar, Department of Physics, University of Antwerp: “Achieving enhanced definition electron microscopy via quantitative phase imaging with ptychography”
 10. Directors’ Board Meeting Lecture, Max Planck Institute of Solid State Research: “High-definition electron microscopy: Greater clarity via multidimensionality”
 11. Institute of Physics Seminar, Chinese Academy of Sciences, Beijing: “Seeing clearer: advancing transmission electron microscopy through multidimensional approaches from ptychography to optical sectioning”
 12. School of Physics Seminar, Peking University: “Advancing transmission electron microscopy through multidimensional approaches from ptychography to optical sectioning”
 13. International Ringberg Castle Workshop on Multidimensionality in Electron Microscopy: “Ptychography: Dose efficiency, aberration correction, and optical sectioning”
- 2017
14. StEM Seminar, Max Planck Institute of Solid State Research: “Phase contrast imaging of radiation sensitive materials using ptychography in a STEM”
 15. University of Vienna Department of Physics Seminar: “Phase contrast imaging of radiation sensitive materials using ptychography in a STEM”
- 2016
16. National University of Singapore Seminar: “Probing materials on the nanoscale with aberration-corrected STEM and first-principles theory”
 17. Max Planck Institute of Microstructure Physics Seminar, Halle: “Probing materials on the nanoscale with aberration-corrected STEM and first-principles theory”
 18. Department of Biology and Chemistry Seminar, Paul Scherrer Institute: “Ptychography in scanning transmission electron microscopy”
- 2015
19. Wuhan National Laboratory for Optoelectronics Seminar, Huazhong University of Science and Technology: “Probing atomic scale dynamics with Z-contrast STEM”
 20. Wuhan University Department of Physics Seminar: “Probing atomic scale dynamics with Z-contrast STEM”
- 2014
21. Physics of Nanostructured Materials Seminar, University of Vienna: “Frontiers in aberration corrected STEM ”

22. Nanoscale Physics Research Lab Seminar, School of Physics and Astronomy, The University of Birmingham: “Probing materials’ functionality on the nanoscale with aberration-corrected STEM and first-principles theory”
23. European Materials Research Society (E-MRS) Fall Meeting: “Resolving the origin of materials’ properties with aberration-corrected STEM and first-principles theory”

SOFTWARE PACKAGES

ptychoSTEM, open source matlab code (GPL licensed) for the processing of 4D scanning transmission electron microscopy (4D STEM) data, in particular for direct non-iterative electron ptychography processing, including the single-side band and Wigner distribution deconvolution methods.

Available on GitLab: <https://gitlab.com/ptychoSTEM/ptychoSTEM>

pyPtychoSTEM, open source python code (GPL licensed) for the processing of 4D scanning transmission electron microscopy (4D STEM) data, in particular for direct non-iterative electron ptychography processing, including the single-side band and Wigner distribution deconvolution methods.

Available on GitLab: <https://gitlab.com/pyptychoSTEM/pyptychoSTEM>

FULL PUBLICATION LIST

JOURNAL ARTICLES

- [1] C. Gao, C. Hofer, D. Jannis, A. Béché, J. Verbeeck and T. J. Pennycook. “Overcoming contrast reversals in focused probe ptychography of thick materials: An optimal pipeline for efficiently determining local atomic structure in materials science”. *Applied Physics Letters* 121 (2022), p. 081906.
- [2] S. Ning, W. Xu, Y. Ma, L. Loh, T. J. Pennycook, W. Zhou, F. Zhang, M. Bosman, S. J. Pennycook, Q. He and et al. “Accurate and Robust Calibration of the Uniform Affine Transformation Between Scan-Camera Coordinates for Atom-Resolved In-Focus 4D-STEM Datasets”. *Microscopy and Microanalysis* 28 (2022), p. 622.
- [3] D. Jannis, C. Hofer, C. Gao, X. Xie, A. Béché, *T. J. Pennycook* and J. Verbeeck. “Event Driven 4D STEM Acquisition With a Timepix3 Detector: Microsecond Dwell Time and Faster Scans for High Precision and Low Dose Applications”. *Ultramicroscopy* 233 (2021), p. 113423.
- [4] J. Madsen, *T. J. Pennycook* and T. Susi. “Ab Initio Description of Bonding for Transmission Electron Microscopy”. *Ultramicroscopy* 231 (2021), p. 113253.
- [5] K. Mustonen, C. Hofer, P. Kotrusz, A. Markevich, M. Hulman, C. Mangler, T. Susi, *T. J. Pennycook*, K. Hricovini, C. M. Richter, J. C. Meyer, J. Kotakoski and V. Skákalová. “Towards Exotic Layered Materials: 2D Cuprous Iodide”. *Advanced Materials* (2021), p. 2106922.
- [6] H. S. Wang, L. Chen, K. Elibol, L. He, H. Wang, C. Chen, C. Jiang, C. Li, T. Wu, C. X. Cong, *T. J. Pennycook*, G. Argentero, D. Zhang, K. Watanabe, T. Taniguchi, W. Wei, Q. Yuan, J. C. Meyer and X. Xie. “Towards Chirality Control of Graphene Nanoribbons Embedded in Hexagonal Boron Nitride”. *Nature Materials* 20 (2021), p. 202.

- [7] A. H. Mahadi, L. Ye, S. M. Fairclough, J. Qu, S. Wu, W. Chen, I. Papaioannou Evangelos, B. Ray, *T. J. Pennycook*, S. J. Haigh, N. P. Young, K. Tedsree, I. S. Metcalfe and S. C. E. Tsang. “Beyond Surface Redox and Oxygen Mobility at Pd-Polar Ceria (100) Interface: Underlying Principle for Strong Metal-Support Interactions in Green Catalysis”. **Applied Catalysis B: Environmental** 270 (2020), p. 118843.
- [8] G. T. Leuthner, S. Hummel, C. Mangler, *T. J. Pennycook*, T. Susi, J. C. Meyer and J. Kotakoski. “Scanning Transmission Electron Microscopy Under Controlled Low-Pressure Atmospheres”. **Ultramicroscopy** 203 (2019), p. 76.
- [9] *T. J. Pennycook*, G. T. Martinez, P. D. Nellist and J. C. Meyer. “High Dose Efficiency Atomic Resolution Imaging via Electron Ptychography”. **Ultramicroscopy** 196 (2019), p. 131.
- [10] T. Susi, J. Madsen, U. Ludacka, J. J. Mortensen, *T. J. Pennycook*, Z. Lee, J. Kotakoski, U. Kaiser and J. C. Meyer. “Efficient First Principles Simulation of Electron Scattering Factors for Transmission Electron Microscopy”. **Ultramicroscopy** 197 (2019), p. 16.
- [11] K. Elibol, T. Susi, G. Argentero, M. R. A. Monazam, *T. J. Pennycook*, J. C. Meyer and J. Kotakoski. “Atomic Structure of Intrinsic and Electron-Irradiation-Induced Defects in MoTe₂”. **Chemistry of Materials** 30 (2018), p. 1230.
- [12] C. Li, G. Habler, T. Griffiths, A. Rechnik, P. Jerabek, L. C. Goetze, C. Mangler, *T. J. Pennycook*, J. Meyer and R. Abart. “Structure Evolution of h.c.p./c.c.p. Metal Oxide Interfaces in Solid-State Reactions”. **Acta Crystallographica Section A: Foundations and Advances** 74 (2018), p. 466.
- [13] G. Argentero, A. Mittelberger, M. R. A. Monazam, Y. Cao, *T. J. Pennycook*, C. Mangler, C. Kramberger, J. Kotakoski, A. K. Geim and J. C. Meyer. “Unraveling the 3D Atomic Structure of a Suspended Graphene/hBN Van Der Waals Heterostructure”. **Nano Letters** 17 (2017), p. 1409.
- [14] B. C. Bayer, S. Caneva, *T. J. Pennycook*, J. Kotakoski, C. Mangler, S. Hofmann and J. C. Meyer. “Introducing Overlapping Grain Boundaries in Chemical Vapor Deposited Hexagonal Boron Nitride Monolayer Films”. **ACS Nano** 11 (2017), p. 4521.
- [15] K. Elibol, T. Susi, M. O’Brien, B. C. Bayer, *T. J. Pennycook*, N. McEvoy, G. S. Duesberg, J. C. Meyer and J. Kotakoski. “Grain Boundary-Mediated Nanopores in Molybdenum Disulfide Grown by Chemical Vapor Deposition”. **Nanoscale** 9 (2017), p. 1591.
- [16] R. Mirzayev, K. Mustonen, M. R. A. Monazam, A. Mittelberger, *T. J. Pennycook*, C. Mangler, T. Susi, J. Kotakoski and J. C. Meyer. “Buckyball Sandwiches”. **Science Advances** 3 (2017), e1700176.
- [17] *T. J. Pennycook*, H. Yang, L. Jones, M. Cabero, A. Rivera-Calzada, C. Leon, M. Varela, J. Santamaria and P. D. Nellist. “3D Elemental Mapping With Nanometer Scale Depth Resolution via Electron Optical Sectioning”. **Ultramicroscopy** 174 (2017), p. 27.
- [18] T. Susi, T. P. Hardcastle, H. Hofsaess, A. Mittelberger, *T. J. Pennycook*, C. Mangler, R. Drummond-Brydson, A. J. Scott, J. C. Meyer and J. Kotakoski. “Single-Atom Spectroscopy of Phosphorus Dopants Implanted Into Graphene”. **2D Materials** 4 (2017), p. 021013.
- [19] T. Susi, V. Skakalova, A. Mittelberger, P. Kotrusz, M. Hulman, *T. J. Pennycook*, C. Mangler, J. Kotakoski and J. C. Meyer. “Computational Insights and the Observation of SiC Nanograin Assembly: Towards 2D Silicon Carbide”. **Scientific Reports** 7 (2017), p. 1.
- [20] C. Li, T. Griffiths, *T. J. Pennycook*, C. Mangler, P. Jerabek, J. C. Meyer, G. Habler and R. Abart. “The Structure of a Propagating MgAl₂O₄/MgO Interface: Linked Atomic-And M-Scale Mechanisms of Interface Motion”. **Philosophical Magazine** 96 (2016), p. 2488.

- [21] C. Li, Y.-Y. Zhang, *T. J. Pennycook*, Y. Wu, A. R. Lupini, N. Paudel, S. T. Pantelides, Y. Yan and S. J. Pennycook. "Column-by-Column Observation of Dislocation Motion in CdTe: Dynamic Scanning Transmission Electron Microscopy". **Applied Physics Letters** 109 (2016), p. 143107.
- [22] M. O'Brien, N. McEvoy, C. Motta, J.-Y. Zheng, N. C. Berner, J. Kotakoski, K. Elibol, *T. J. Pennycook*, J. C. Meyer, C. Yim, M. Abid, T. Hallam, J. F. Donegan, S. Sanvito and G. S. Duesberg. "Raman Characterization of Platinum Diselenide Thin Films". **2D Materials** 3 (2016), p. 021004.
- [23] S. L. Rhode, M. K. Horton, S. .-. Sahonta, M. J. Kappers, S. J. Haigh, *T. J. Pennycook*, C. McAleese, C. J. Humphreys, R. O. Dusane and M. A. Moram. "Dislocation Core Structures in (0001) InGaN". **Journal of Applied Physics** 119 (2016), p. 105301.
- [24] X. Shen, *T. J. Pennycook*, D. Hernandez-Martin, A. Perez, Y. S. Puzyrev, Y. Liu, S. G. E. te Velthuis, J. W. Freeland, P. Shafer, C. Zhu, M. Varela, C. Leon, Z. Sefrioui, J. Santamaria and S. T. Pantelides. "High on/Off Ratio Memristive Switching of Manganite/Cuprate Bilayer by Interfacial Magnetoelectricity". **Advanced Materials Interfaces** 3 (2016), p. 1600086.
- [25] S. Stehlik, M. Varga, M. Ledinsky, D. Miliarieva, H. Kozak, V. Skakalova, C. Mangler, *T. J. Pennycook*, J. C. Meyer, A. Kromka and B. Rezek. "High-Yield Fabrication and Properties of 1.4 Nm Nanodiamonds With Narrow Size Distribution". **Scientific Reports** 6 (2016), p. 38419.
- [26] T. Susi, C. Hofer, G. Argentero, G. T. Leuthner, *T. J. Pennycook*, C. Mangler, J. C. Meyer and J. Kotakoski. "Isotope Analysis in the Transmission Electron Microscope". **Nature Communications** 7 (2016), p. 13040.
- [27] H. Yang, R. N. Rutte, L. Jones, M. Simson, R. Sagawa, H. Ryll, M. Huth, *T. J. Pennycook*, M. L. H. Green, H. Soltau, Y. Kondo, B. G. Davis and P. D. Nellist. "Simultaneous Atomic-Resolution Electron Ptychography and Z-Contrast Imaging of Light and Heavy Elements in Complex Nanostructures". **Nature Communications** 7 (2016), p. 12532.
- [28] T. P. Almeida, A. R. Muxworthy, T. Kasama, W. Williams, C. Damsgaard, C. Frandsen, *T. J. Pennycook* and R. E. Dunin-Borkowski. "Effect of Maghemization on the Magnetic Properties of Nonstoichiometric Pseudo-Single-Domain Magnetite Particles". **Geochemistry Geophysics Geosystems** 16 (2015), p. 2969.
- [29] Z. Fan, Y. Wang, Y. Zhang, T. Qin, X. R. Zhou, G. E. Thompson, *T. J. Pennycook* and T. Hashimoto. "Grain Refining Mechanism in the Al/Al-Ti-B System". **Acta Materialia** 84 (2015), p. 292.
- [30] M. K. Horton, S. Rhode, S.-L. Sahonta, M. J. Koppers, S. J. Haigh, *T. J. Pennycook*, C. J. Humphreys, R. O. Dusane and M. A. Moram. "Segregation of In to Dislocations in InGaN". **Nano Letters** 15 (2015), p. 923.
- [31] L. Jones, H. Yang, *T. J. Pennycook*, M. S. J. Marshall, S. Van Aert, N. D. Browning, M. R. Castell and P. D. Nellist. "Smart Align-a New Tool for Robust Non-Rigid Registration of Scanning Microscope Data". **Advanced Structural and Chemical Imaging** 1 (2015), p. 8.
- [32] I. MacLaren, B. Sala, S. M. L. Andersson, *T. J. Pennycook*, J. Xiong, Q. X. Jia, E.-M. Choi and J. L. MacManus-Driscoll. "Strain Localization in Thin Films of Bi(Fe,Mn)O₃ Due to the Formation of Stepped Mn(4+)-Rich Antiphase Boundaries." **Nanoscale Research Letters** 10 (2015), p. 407.
- [33] *T. J. Pennycook*, A. R. Lupini, H. Yang, M. F. Murfitt, L. Jones and P. D. Nellist. "Efficient Phase Contrast Imaging in STEM Using a Pixelated Detector. Part 1: Experimental Demonstration at Atomic Resolution". **Ultramicroscopy** 151 (2015), p. 160.

- [34] S. L. Rhode, M. K. Horton, W. Y. Fu, S. L. Sahonta, M. J. Kappers, *T. J. Pennycook*, C. J. Humphreys, R. O. Dusane and M. A. Moram. "Dislocation Core Structures in Si-Doped GaN". **Applied Physics Letters** 107 (2015), p. 243104.
- [35] K. Sohlberg, *T. J. Pennycook*, W. Zhou and S. J. Pennycook. "Insights Into the Physical Chemistry of Materials From Advances in HAADF-STEM". **Physical Chemistry Chemical Physics** 17 (2015), p. 3982.
- [36] S. Stehlik, M. Varga, M. Ledinsky, V. Jirasek, A. Artemenko, H. Kozak, L. Ondic, V. Skakalova, G. Argentero, *T. J. Pennycook*, J. C. Meyer, A. Fejfar, A. Kromka and B. Rezek. "Size and Purity Control of HPHT Nanodiamonds Down to 1 Nm". **Journal of Physical Chemistry C** 119 (2015), p. 27708.
- [37] J. A. Thomas, S. P. Ashby, F. Huld, *T. J. Pennycook* and Y. Chao. "Synthesis of Low-Oxide Blue Luminescent Alkyl-Functionalized Silicon Nanoparticles With No Nitrogen Containing Surfactant". **Journal of Nanoparticle Research** 17 (2015), p. 227.
- [38] H. Yang, J. G. Lozano, *T. J. Pennycook*, L. Jones, P. B. Hirsch and P. D. Nellist. "Imaging Screw Dislocations at Atomic Resolution by Aberration-Corrected Electron Optical Sectioning". **Nature Communications** 6 (2015), p. 7266.
- [39] H. Yang, *T. J. Pennycook* and P. D. Nellist. "Efficient Phase Contrast Imaging in STEM Using a Pixelated Detector. Part II: Optimisation of Imaging Conditions". **Ultramicroscopy** 151 (2015), p. 232.
- [40] Y. Y. Zhang, R. Mishra, *T. J. Pennycook*, A. Y. Borisevich, S. J. Pennycook and S. T. Pantelides. "Oxygen Disorder, a Way to Accommodate Large Epitaxial Strains in Oxides". **Advanced Materials Interfaces** 2 (2015), p. 1500344.
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