



Dr. Liam Collins

R&D Staff Scientist

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EDUCATION

Doctor of Philosophy (Physics)	University College Dublin	2015
Masters of Science (Applied Physics)	University of Limerick	2009
Bachelor of Science (Science Education)	University of Limerick	2008

RELEVANT RESEARCH EXPERIENCE

Staff Scientist (R&D Associate)	July 2018- Present
Oak Ridge National Laboratory, Center of Nanophase Materials Sciences, Scanning Probe Microscopy Group	
Postdoctoral Research Associate	2015-July 2018
Oak Ridge National Laboratory, Center of Nanophase Materials Sciences, Scanning Probe Microscopy Group	
Graduate Researcher	2010-2015
University College Dublin, School of Physics & Conway Institute of Biomolecular and Biomedical Research	

RESEARCH AWARDS AND HONORS

CNMS Outstanding Staff Member Award	2020
CNMS User Meeting	
Significant Event Award	2020
Implementation of Interferometric Scanning Probe methods	
CNMS Distinguished Patent Award	2018
For the development of Electrochemical force microscopy (EcFM)	
Postdoctoral Award	2017
CNMS Division Awards	
R&D 100 Award	2016
For development of G-Mode SPM	
Microscopy Today Innovation Award	2016

Microscopy Society of America
MRS Graduate Student Gold Award
Material Research Society (Spring Meeting)

2014

PATENTS

Invention: Electrochemical Force Microscopy (2014)

Inventors: Collins L, Jesse S, Kalinin S K, Rodriguez B J, US Patent 9,541,576.

Invention Disclosure: Methods for Determination of Electrostatic Blind Spot in Voltage Modulated Atomic Force Microscopies (2022)

(Liam Collins, Jason Kilgore (NIST)) OMB Control Number: 0693-0085

FUNDING ACTIVITIES

FY22 National Nuclear Security Administration NA-22 (**Awarded 840 k**)

- “Nanoscale Nuclear Materials Analysis for Nonproliferation”

FY20 Carbon capture Seed proposal: (**Awarded 450 k**) Lois ID 10606

- “High entropy alloys (HEAs) for CO₂ reduction”

SERVICE AND COMMITTEE MEMBERSHIP

2021-present: Ultramicroscopy Editorial Board Member

2021-2023: CNMS User Executive Committee

2018-2021: Molecular Foundry Proposal Review Board

CONFERENCE ORGANIZING

- **November 26th – December 1st 2023** - Co-Organizer “Advanced Characterization Methods of Energy Material Applications” at MRS Fall 2023, Place: Boston
- **June 19th – June 21st 2023** - Co-Organizer of SPM Connect, Place: Washington, DC.
- **August 8th-12th 2022** – Co-Organizer “2022 CNMS User Meeting”, Place: Online
- **August 15th-16th 2022** – Co-Organizer “Nano4Neuro Workshop”, Place: Online
- **June 28th – July 2nd 2021** – Co-organized the Joint iSPM³ international conference: Scanning probe Microscopy of Soft and Polymeric Materials (SPMonSPM) and the international scanning probe microscopy (iSPM). June 28th – July 2nd, 2021, Virtual.
- **April 25-30th 2021** – Symposium organizer “Imaging of Emerging Phenomena in Electroceramics” at the 8th International Congress on Ceramics (ICC8), Place: Virtual//Busan, Korea.

REFEREEING ACTIVITIES

Nature (Nature Communications, Scientific Reports, Computational Materials), Journal of the American Chemical Society, Physical Review Letters, Physical Review B, Advanced

Functional Materials, Journal of Vacuum Science and Technology, ACS Nano, AIP Advances, ACS Applied Materials and Interfaces, Nanotechnology, Applied Physics Letters, Ultramicroscopy, Review of Scientific Instruments, Langmuir, Journal of Physical Chemistry.

MENTORSHIP

Checa, Marti – Theme postdoc. *Sc. Output: 4 lead papers, 2 invited talks.*

Peters, Travis - Penn State, Long term user, 1 year *Output: 2 lead papers.*

SELECTED PUBLICATIONS

Cumulative Total Number of publications: 107; h-index: 27; ~2700 citations
([Google Scholar Profile](#))

Selected Book chapters

- Checca, M., Neumayer, S. M., Tsai WY., **Collins, L.**, *Advanced Modes of Electrostatic and Kelvin Probe Force Microscopy for energy applications*; in *Atomic Force Microscopy for Energy Research*, Taylor and Francis, **2021**.
- **Collins, L.**; Somnath, S.; Kalinin, S.V.; Belianinov, A., *Scanning probe microscopy in the information age*; in *Handbook on Big Data and Machine Learning in the Physical Sciences; Vol 1*, World Scientific, **2020**, 49-99.
- **Collins, L.**; Weber, S.; Rodriguez, B., *Applications of KPFM-based approaches for surface potential and electrochemical measurements in liquid*; in *Kelvin probe force microscopy*; 2nd Ed, Springer: New York, **2018**, 49-99.

Selected Review Articles

- **Collins, L.**; Kilpatrick, J.; Kalinin, S. V.; Rodriguez, B. J. **2018** Nanoscale Electrical Measurements in Liquids Using AFM-Progress and Outlook. *Rep. Prog. Phys.*, **2018**, 81 (8), 086101.

Selected Journal Articles

- Checa, M., Fuhr, A. S., Sun, C., Vasudevan, R., Ziatdinov, M., Ivanov, I., ... & **Collins, L.** High-speed mapping of surface charge dynamics using sparse scanning Kelvin probe force microscopy. *Nature Communications*, **2023**, 14(1), 7196.
- Lomenzo, P. D., **Collins, L.**, Ganser, R., Xu, B., Guido, R., Gruverman, A., ... & Schroeder, U. Discovery of Nanoscale Electric Field-Induced Phase Transitions in ZrO₂. *Advanced Functional Materials*, **2023**. 33(41), 2303636.

- Peters, T., Zhu, W., Checa, M., **Collins, L.**, & Trolier-McKinstry, S. Influence of doping and thickness on domain avalanches in lead zirconate titanate thin films. *App. Phys. Lett.*, **2023**, 122(13), 132906.
- Hennessey, G., Peters, T., Tipsawat, P., Checa, M., **Collins, L.**, & Trolier-McKinstry, S. Domain Wall Motion Across Microstructural Features in Polycrystalline Ferroelectric Films. *Acta Materialia*, **2023**, 118871.
- Checa, M., Jin, X., Millan-Solsona, R., Neumayer, S. M., Susner, M. A., McGuire, M. A., ... & **Collins, L.**, Revealing Fast Cu-Ion Transport and Enhanced Conductivity at the CuInP2S6-In4/3P2S6 Heterointerface. *ACS nano*, **2022**, 16(9), 15347-15357.
- Kang, S., Jang, W. S., Morozovska, A. N., Kwon, O., Jin, Y., Kim, Y. H., **Collins, L.** ... & Kim, Y. Highly enhanced ferroelectricity in HfO2-based ferroelectric thin film by light ion bombardment. *Science*, **2022**, 376(6594), 731-738.
- **Collins, L.**; Liu, Y.; Ovchinnikova, O.S.; and Proksch, R., Quantitative electromechanical atomic force microscopy. *ACS nano*, **2019**, 13(7), pp.8055-8066.
- Liu, Y.; **Collins, L.**; Proksch, R.; Kim, S.; Watson, B. R.; Doughty, B., ... & Ovchinnikova, O., Chemical nature of ferroelastic twin domains in CH3N3Pb3 perovskite. *Nat. Mat.*, **2018**, 17 (11), 1013,
- **Collins, L.**; Ahmadi, M.; Wu, T.; Hu, B.; Kalinin, S. V.; Jesse, S., Breaking the Time Barrier in Kelvin Probe Force Microscopy: Fast Free Force Reconstruction Using the G-Mode Platform. *ACS Nano*, **2017**, 11 (9), 8717-8729.
- **Collins, L.**; Jesse, S.; Kilpatrick, J. I.; Tselev, A.; Varenyk, O.; Okatan, M. B.; Weber, S. A.; Kumar, A.; Balke, N.; Kalinin, S. V., Probing Charge Screening Dynamics and Electrochemical Processes at the Solid-Liquid Interface with Electrochemical Force Microscopy. *Nat. Comm.*, **2014**, 5, 3871.

SELECTED ORAL PRESENTATIONS

Invited

- **Quantifying Nanoscale Electromechanical Coupling**, International Symposium on Applications of Ferroelectrics (ISAF), June 2023, Cleveland, USA.
- **Tracking charge dynamics by high speed and time resolved Kelvin Probe Force Microscopy**, 20th International Microscopy Congress (IMC20), September 2023, South Korea.
- **Quantification of Functional Material Parameters by Piezoresponse force microscopy**, Bruker North American User Meeting, May 2021 (virtual).
- **Quantification of Functional Material Parameters by Interferometric AFM**, Center for Nanophase Material Sciences Seminar Series, October 2020, TN, USA.

- **Investigation of ferroic properties in Hybrid Organic Inorganic Perovskites by interferometric piezoresponse force microscopy**, Max Planck Institute for polymeric research, May 2020, Mainz, Germany.
- **Quantitative piezoresponse force microscopy using interferometric detection**, NanoGE, November 2019, Berlin, Germany.
- **Quantitative and ultrafast imaging of nanoscale functionalities using advanced atomic force microscopy**, University College Dublin, School of Physics, November 2019, Dublin, Ireland.
- **Probing Ultrafast charge dynamics using G-Mode KPFM**, International Conference on Scanning Probe Microscopy on Soft and Polymeric Materials (SPMonSPM), August 2018, Leuven, Belgium.
- **Probing local electrochemical functionalities at solid-liquid interfaces** 231st Electrochemical Society (ECS) biannual meeting , May 2017, New Orleans, USA.

Contributed

- Materials Research Society, Dec 2017, Boston, MA, USA. *Title: "Breaking the Time Barrier in Kelvin Probe Force Microscopy"*.
- Materials Research Society, Dec 2017, Boston, MA, USA. *Title: "Electrochemical Force microscopy: Nanoscale force based electrochemical measurements in-situ"*.
- Tech Connect, Dec 2017, Ann Harbour, VA, USA. *Title: "Bringing Kelvin probe force microscopy into the information age"*.
- 5th Multifrequency AFM, June 2014, Madrid, Spain. *Title: "Electrochemical force microscopy: Probing local charge screening, ion diffusion, and electrochemical processes at the solid-liquid interface"*.
- Materials Research Society, April 2014, San Francisco, Ca, USA. *Title: "Electrochemical force microscopy: Probing local charge screening, ion diffusion, and electrochemical processes at the solid-liquid interface"*. (Recipient of Gold MRS Graduate Student award.)
- Materials Research Society, Dec 2013, Boston, MA, USA. *Title: "Force volume band excitation KPFM: Combined amplitude and frequency modulated KPFM"*.
- Materials Research Society, Dec 2013, Boston, MA, USA. *Title: "Realizing Kelvin Probe Force Microscopy in Liquid Environments through Multidimensional Spectroscopic Imaging"*.
- 3rd Multifrequency AFM, March 2011, Madrid, Spain. *Title: "Open loop-Kelvin Probe force microscopy techniques in the single and multi-frequency domains"*.
- Materials Research Society, Dec 2011, Boston, MA, USA. *Title: "Dual harmonic-Kelvin probe force microscopy for characterization of surface potentials"*.
- 24th European Conference on Biomaterials, June 2011, Dublin, Ireland. *Title: "Nanoscale electrostatic characterization of biomaterials"*.

FULL LIST OF PUBLICATIONS

2024

1. Gupta, S., Sohail, T., Checa, M., Rohewal, S. S., Toomey, M. D., Kanbargi, N., ... & Bowland, C. C. (2024). Enhancing Composite Toughness Through Hierarchical Interphase Formation. *Advanced Science*, 11(6), 2305642.
2. Vlassioux, I., Smirnov, S., Poretzky, A., Olunloyo, O., Geohegan, D. B., Dyck, O., ... & Ivanov, I. (2024). Armor for Steel: Facile Synthesis of Hexagonal Boron Nitride Films on Various Substrates. *Advanced Materials Interfaces*, 11(1), 2300704.

2023

3. Lomenzo, P. D., **Collins, L.**, Ganser, R., Xu, B., Guido, R., Gruverman, A., ... & Schroeder, U. (2023). Discovery of Nanoscale Electric Field-Induced Phase Transitions in ZrO₂. *Advanced Functional Materials*, 33(41), 2303636.
4. Miskowiec, A., Brubaker, Z. E., Neu, J., Niedziela, J. L., **Collins, L.**, & Braatz, A. (2023). Isoplethal study of phase formation and morphology in uranium-304L steel via scanning electron microscopy. *Journal of Nuclear Science and Technology*, 1-12.
5. Checa, M., Kelley, K. P., Vasudevan, R., **Collins, L.**, & Jesse, S. (2023). Automated piezoresponse force microscopy domain tracking during fast thermally stimulated phase transition in CuInP₂S₆. *Nanotechnology*, 34(32), 325703.
6. Hennessey, G., Peters, T., Tipsawat, P., Checa, M., **Collins, L.**, & Trolrier-McKinstry, S. (2023). Domain wall motion across microstructural features in polycrystalline ferroelectric films. *Acta Materialia*, 250, 118871.
7. Kang, K. T., Corey, Z. J., Hwang, J., Sharma, Y., Paudel, B., Roy, P., ... & Chen, A. (2023). Heterogeneous Integration of Freestanding Bilayer Oxide Membrane for Multiferroicity. *Advanced Science*, 10(15), 2207481.
8. Xu, B., **Collins, L.**, Holsgrove, K. M., Mikolajick, T., Schroeder, U., & Lomenzo, P. D. (2023). Influence of the ozone dose time during atomic layer deposition on the ferroelectric and pyroelectric properties of 45 nm-thick ZrO₂ films. *ACS Applied Electronic Materials*, 5(4), 2288-2295.
9. Peters, T., Zhu, W., Checa, M., **Collins, L.**, & Trolrier-McKinstry, S. (2023). Influence of doping and thickness on domain avalanches in lead zirconate titanate thin films. *Applied Physics Letters*, 122(13).
10. Angelopoulou, P. P., Kearney, L. T., Keum, J. K., **Collins, L.**, Kumar, R., Sakellariou, G., ... & Hong, K. (2023). High- χ diblock copolymers containing poly (vinylpyridine-N-oxide) segments. *Journal of Materials Chemistry A*, 11(18), 9846-9858.
11. Yoon, T., Mason, D., Jain, V., Chu, Y., Kharel, P., Renninger, W. H., **Collins L.**... & Rakich, P. T. (2023). Simultaneous Brillouin and piezoelectric coupling to a high-frequency bulk acoustic resonator. *Optica*, 10(1), 110-117.
12. Domingo Marimon, N., Pesquera Herrero, D., **Collins, L.**, Kelley, K., Jesse, S., & Checa, M. (2023). BE PFM and BE CRF for functional studies of free-standing ferroelectric membranes and thin films. *Bulletin of the American Physical Society*.

2022

13. Checa, M., Jin, X., Millan-Solsona, R., Neumayer, S. M., Susner, M. A., McGuire, M. A., ... & **Collins, L.** (2022). Revealing Fast Cu-Ion Transport and Enhanced Conductivity at the CuInP2S6–In4/3P2S6 Heterointerface. *ACS nano*.
14. Checa, M., Ivanov, I., Neumayer, S. M., Susner, M. A., McGuire, M. A., Maksymovych, P., & **Collins, L.** (2022). Correlative piezoresponse and micro-Raman imaging of CuInP2S6–In4/3P2S6 flakes unravels phase-specific phononic fingerprint via unsupervised learning. *Applied Physics Letters*, 121(6), 062901.
15. Kang, S., Jang, W. S., Morozovska, A. N., Kwon, O., Jin, Y., Kim, Y. H., **Collins, L.** ... & Kim, Y. (2022). Highly enhanced ferroelectricity in HfO2-based ferroelectric thin film by light ion bombardment. *Science*, 376(6594), 731-738.
16. (book chapter) Checa, M., Neumayer, S. M., Tsai, W. Y., & **Collins, L.** (2022). Advanced Modes of Electrostatic and Kelvin Probe Force Microscopy for Energy Applications. In *Atomic Force Microscopy for Energy Research* (pp. 45-104). CRC Press.
17. Hu, B., Carrillo, J. M., **Collins, L.**, Silmore, K. S., Keum, J., Bonnesen, P. V., ... & Lokitz, B. S. (2022). Modular Approach for the Synthesis of Bottlebrush Diblock Copolymers from Poly (Glycidyl Methacrylate)-block-Poly (Vinylidimethylazlactone) Backbones. *Macromolecules*, 55(2), 488-497.
18. Barroca, N., **Collins, L.**, Rodriguez, B. J., Fernandes, M. H. V., & Vilarinho, P. M. (2022). Mechanical writing of electrical polarization in poly (L-lactic) acid. *Acta Biomaterialia*, 139, 249-258.
19. Killgore, J. P., Robins, L., & **Collins, L.** (2022). Electrostatically-blind quantitative piezoresponse force microscopy free of distributed-force artifacts. *Nanoscale Advances*, 4(8), 2036-2045.

2021

20. Smith, H., **Collins, L.**, & Sehirlioglu, A. (2021). Surface Dynamics of Charge Transport in LaAlO3/SrTiO3 with Time-Resolved Kelvin Probe Force Microscopy. *ACS Applied Electronic Materials*, 4(1), 206-216.
21. Kanbargi, N., Goswami, M., **Collins, L.**, Kearney, L. T., Bowland, C. C., Kim, K., ... & Naskar, A. K. (2021) Synthesis of High-Performance Lignin-Based Inverse Thermoplastic Vulcanizates with Tailored Morphology and Properties. *ACS Applied Polymer Materials*, , 3(6), 2911-2920.
22. Liu, Y., Trimby, P., **Collins, L.**, Ahmadi, M., Winkelmann, A., Proksch, R., & Ovchinnikova, O. S. Correlating crystallographic orientation and ferroic properties of twin domains in metal halide perovskites. *ACS nano*, 2021 15(4), 7139-7148.
23. Neumayer, Sabine M., Sahar Saremi, Lane W. Martin, **Liam Collins**, Alexander Tselev, Stephen Jesse, Sergei V. Kalinin, and Nina Balke. Piezoresponse amplitude and phase quantified for electromechanical characterization., *Journal of Applied Physics*, 2020, 28(17), 171105.
24. **Collins, L.**, Killgore, J., Berweger, S., Cohn, R., Domingo Marimon, N., Fantner, G., ... & Yablon, D. (2021). Perspectives in Scanning Probe Microscopy from the 2021 Joint

International Scanning Probe Microscopy and Scanning Probe Microscopy on Soft and Polymeric Materials Conference. *Microscopy and Analysis*, 57(1).

25. Liu, Y.; Borodinov, N.; **Collins, L.**; Ahmadi, M.; Kalinin, S.V.; Ovchinnikova, O.S. ; & Levlev, A.V., Role of Decomposition Product Ions in Hysteretic Behavior of Metal Halide Perovskite. *ACS Nano* **2021**, 15 (5), 9017–9026
26. Sharma, Y.; Mazza, A.R.; Musico, B.L.; Skoropata, E.; Nepal, R., **Collins L.**; Levlev, A. V.; et al. Magnetic Texture in Insulating Single Crystal High Entropy Oxide Spinel Films. *ACS Applied Materials & Interfaces* **2021**, 13 (15), 17971-17977.
27. Liu, Y.; Trimby, P.; **Collins, L.**; Ahmadi, M.; Winkleman, A.; Proksch, R.; & Ovchinnikova, O.S., Role of Decomposition Product Ions in Hysteretic Behavior of Metal Halide Perovskite. *ACS nano* **2021**, 15 (4), 7139–7148
28. Paull, O.; Xu, C.; Cheng, X.; Zhang, Y.; Xu, B.; Kelley, K.; **Collins, L.** et al. Super-R BiFeO₃: Epitaxial stabilization of a low-symmetry phase with giant electromechanical response. *Nature Materials*, **2021**, (Under review).
29. Liu, Y.; Borodinov, N.; **Collins, L.**; Ahmadi, M.; Kalinin, S.V.; Ovchinnikova, O.S. ; & Levlev, A.V., Role of Decomposition Product Ions in Hysteretic Behavior of Metal Halide Perovskite. *ACS Nano* **2021**, 15 (5), 9017–9026

2020

30. Neumayer, S.M.; Saremi, S.; Martin, L.W.; **Collins, L.**; Tselev, A.; Jesse, S.; Kalinin, S.V.; and Balke, N., Piezoresponse amplitude and phase quantified for electromechanical characterization. *Journal of Applied Physics* **2020**, 128 (17), 171105.
31. Liu, Y.; Ievlev, A.; **Collins L.**; Borodinov, N.; Kalinin, S.; Ovchinnikova, O., Operando Imaging of Ion Migration in Metal Halide Perovskites. *Microscopy and Microanalysis*, **2020**, 26, 2046-2048.
32. Kelley, K. P.; Ziatdinov, M.; **Collins L.**; Susner, M. A.; Vasudevan, R. K.; Balke, N.; Kalinin, S. V.; Jesse, S., Fast Scanning Probe Microscopy via Machine Learning: Non-rectangular scans with compressed sensing and Gaussian process optimization. *Small* **2020**, 16 (37), 2002878.
33. **Collins L.**; Vasudevan, R. K.; Sehrioglu, A., Visualizing Charge Transport and Nanoscale Electrochemistry by Hyperspectral Kelvin Probe Force Microscopy. *ACS Applied Materials & Interfaces* **2020**, 12 (29), 33361-33369.
34. **Collins L.**; Muckley, E. S.; Tsai, H.; Ghosh, D.; Neukirch, A. J.; Tretiak, S.; Kalinin, S. V.; Nie, W.; Ivanov, I. N., Correlation of Spatiotemporal Dynamics of Polarization and Charge Transport in Blended Hybrid Organic–Inorganic Perovskites on Macro-and Nanoscales. *ACS Applied Materials & Interfaces* **2020**, 12 (13), 15380-15388.
35. **Collins L.**; Muckley, E.; Tsai, H.; Ghosh, D.; Neukirch, A. J.; Tretiak, S.; Kalinin, S.; Nie, W.; Ivanov, I., Understanding Multiscale Charge Dynamics in Mixed Ionic Electronic Conductors: Linking Hysteresis with Local Functionality. *ACS Applied Materials and Interfaces* **2020**, 12 (LA-UR-19-28377).
36. **Collins L.**; Celano, U., Revealing Antiferroelectric Switching and Ferroelectric Wakeup in Hafnia by Advanced Piezoresponse Force Microscopy. *ACS Applied Materials & Interfaces* **2020**, 12 (37), 41659-41665.
37. Ziatdinov, M.; Kim, D.; Neumayer, S.; Vasudevan, R. K.; **Collins L.**; Jesse, S.; Ahmadi, M.; Kalinin, S. V., Imaging mechanism for hyperspectral scanning probe

microscopy via Gaussian process modelling. *npj Computational Materials* **2020**, *6* (1), 1-7.

38. Ziatdinov, M.; Kim, D.; Neumayer, S.; **Collins L.**; Ahmadi, M.; Vasudevan, R. K.; Jesse, S.; Ann, M. H.; Kim, J. H.; Kalinin, S. V., Super-resolution and signal separation in contact Kelvin Probe Force Microscopy of Electrochemically Active Ferroelectric Materials. *arXiv preprint arXiv:2002.03591* **2020**.
39. Sharma, Y.; Agarwal, R.; **Collins L.**; Zheng, Q.; Ievlev, A. V.; Hermann, R. P.; Cooper, V. R.; Kc, S.; Ivanov, I. N.; Katiyar, R. S., Self-Assembled Room Temperature Multiferroic BiFeO₃-LiFe₅O₈ Nanocomposites. *Advanced Functional Materials* **2020**, *30* (3), 1906849.
40. Neumayer, S. M.; Saremi, S.; Martin, L. W.; **Collins L.**; Tselev, A.; Jesse, S.; Kalinin, S. V.; Balke, N., Piezoresponse amplitude and phase quantified for electromechanical characterization. *Journal of Applied Physics* **2020**, *128* (17), 171105.
41. Muckley, E. S.; **Collins L.**; Srijanto, B. R.; Ivanov, I. N., Machine Learning-Enabled Correlation and Modeling of Multimodal Response of Thin Film to Environment on Macro and Nanoscale Using "Lab-on-a-Crystal". *Advanced Functional Materials* **2020**, *30* (10), 1908010.
42. Liu, Y.; Li, M.; Wang, M.; **Collins L.**; Ievlev, A. V.; Jesse, S.; Xiao, K.; Hu, B.; Belianinov, A.; Ovchinnikova, O. S., Twin domains modulate light-matter interactions in metal halide perovskites. *APL Materials* **2020**, *8* (1), 011106.
43. Liu, Y.; Ievlev, A. V.; **Collins L.**; Belianinov, A.; Keum, J. K.; Ahmadi, M.; Jesse, S.; Retterer, S. T.; Xiao, K.; Huang, J., Strain-Chemical Gradient and Polarization in Metal Halide Perovskites. *Advanced Electronic Materials* **2020**, *6* (4), 1901235.
44. Kim, S. W.; Tan, X.; Frank, C. E.; Deng, Z.; Wang, H.; **Collins L.**; Lapidus, S. H.; Jin, C.; Gopalan, V.; Kalinin, S. V., High-Pressure, High-Temperature Synthesis and Characterization of Polar and Magnetic LuCrWO₆. *Inorganic chemistry* **2020**, *59* (6), 3579-3584.
45. Kelley, K.; Yilmaz, D.; **Collins L.**; Sharma, Y.; Lee, H.; Akbarian, D.; Van Duin, A.; Ganesh, P.; Vasudevan, R., Thickness and strain dependence of piezoelectric coefficient in BaTiO₃ thin films. *Physical Review Materials* **2020**, *4* (2), 024407.
46. **Collins, L.**; Somnath, S.; Kalinin, S.V.; Belianinov, A., Scanning probe microscopy in the information age; in *Handbook on Big Data and Machine Learning in the Physical Sciences; Vol 1, World Scientific*, **2020**, 49-99.
47. Hermes, I. M.; Best, A.; Winkelmann, L.; Mars, J.; Vorpahl, S. M.; Mezger, M.; **Collins L.**; Butt, H.-J.; Ginger, D. S.; Koynov, K., The anisotropy of the carrier diffusion in single MAPbI₃ grains correlates to their twin domains. *Energy & Environmental Science* **2020**, *13* (11), 4168-4177.
48. Celano, U.; Gomez, A.; Piedimonte, P.; Neumayer, S.; **Collins L.**; Popovici, M.; Florent, K.; McMitchell, S. R.; Favia, P.; Drijbooms, C., Ferroelectricity in Si-Doped Hafnia: Probing Challenges in Absence of Screening Charges. *Nanomaterials* **2020**, *10* (8), 1576.

2019

49. Tsai, W.-Y.; Come, J.; Zhao, W.; Wang, R.; Feng, G.; Thapaliya, B. P.; Dai, S.; **Collins L.**; Balke, N., Hysteretic order-disorder transitions of ionic liquid double layer structure on graphite. *Nano Energy* **2019**, *60*, 886-893.

50. Sharma, Y.; Wong, A. T.; Herklotz, A.; Lee, D.; Ievlev, A. V.; **Collins L.**; Lee, H. N.; Dai, S.; Balke, N.; Rack, P. D., Ionic Gating of Ultrathin and Leaky Ferroelectrics. *Advanced Materials Interfaces* **2019**, *6* (5), 1801723.
51. Sharma, Y.; Mazza, A.; Skoropata, E.; **Collins L.**; Gai, Z.; Ward, T., Magnetic Structure in Entropy Stabilized Single Crystal Spinel Ferrite Films. *APS* **2019**, *2019*, T70. 326.
52. Sharma, Y.; Holt, M. V.; Laanait, N.; Gao, X.; Ivanov, I. N.; **Collins L.**; Sohn, C.; Liao, Z.; Skoropata, E.; Kalinin, S. V., Competing phases in epitaxial vanadium dioxide at nanoscale. *APL Materials* **2019**, *7* (8), 081127.
53. Liu, Y.; Ievlev, A. V.; **Collins L.**; Borodinov, N.; Belianinov, A.; Keum, J. K.; Wang, M.; Ahmadi, M.; Jesse, S.; Xiao, K., Light-Ferroic Interaction in Hybrid Organic-Inorganic Perovskites. *Advanced Optical Materials* **2019**, *7* (23), 1901451.
54. Liu, Y.; Ievlev, A. V.; **Collins L.**; Belianinov, A.; Kim, S.; Doughty, B.; Jesse, S.; Ahmadi, M.; Retterer, S. T.; Xiao, K., Multi-Model Imaging of Local Chemistry and Ferroic Properties of Hybrid Organic-Inorganic Perovskites. *Microscopy and Microanalysis* **2019**, *25* (S2), 2076-2077.
55. Liu, Y.; **Collins L.**; Proksch, R.; Kim, S.; Watson, B. R.; Doughty, B.; Calhoun, T. R.; Ahmadi, M.; Ievlev, A. V.; Jesse, S., Reply to: On the ferroelectricity of CH₃NH₃PbI₃ perovskites. *Nature materials* **2019**, *18* (10), 1051-1053.
56. Liu, Y.; Belianinov, A.; **Collins L.**; Proksch, R.; Ievlev, A. V.; Hu, B.; Kalinin, S. V.; Ovchinnikova, O. S., Ferroic twin domains in metal halide perovskites. *MRS Advances* **2019**, *4* (51-52), 2817-2830.
57. Liu, F.; Abel, S. M.; **Collins L.**; Srijanto, B. R.; Standaert, R.; Katsaras, J.; Collier, C. P., Steady-State Diffusion: Geometry-Dependent Nonequilibrium Steady-State Diffusion and Adsorption of Lipid Vesicles in Micropillar Arrays (Adv. Mater. Interfaces 9/2019). *Advanced Materials Interfaces* **2019**, *6* (9), 1970055.
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