

Lang YUAN, PhD

Associate Professor

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EDUCATION

- October 2006 – April 2010 **Imperial College London, UK, Ph.D.** in Materials Science and Engineering
- Thesis: *"Multiscale Modelling of the Influence of Convection on Dendrite Formation and Freckle Initiation during Vacuum Arc Remelting"*
 - Key author of Open-source code μ MatIC (<http://www.imperial.ac.uk/engineering-alloys/research/software/>)
 - Supervisors: Prof. P. D. Lee and Prof. K. A. Pericleous (University of Greenwich)
 - **Imperial College London Awards: McLean Medal**
- September 2003 – May 2006 **Tsinghua University, China, M. Eng.** in Materials Processing and Engineering
- Thesis: *"Numerical Simulation of Shot Process in Shot Sleeve of Die Casting Process"*
 - Supervisor: Prof. Baicheng Liu and Prof. Shoumei Xiong
- September 1999 – June 2003 **Tsinghua University, China, B. Eng.** in Mechanical Engineering
- **Excellent Graduate of Tsinghua University**

WORK EXPERIENCE

- August 2018 – Present Associate Professor, Mechanical Engineering, University of South Carolina, UAS
- November 2012 – August 2018 Lead Research Engineer, Additive Core Discipline, GE Global Research (GEGR), USA
- October 2011 – November 2012 Research Fellow, Microstructural Modelling and In Situ Imaging of Solidification Defects in Steels, The Manchester X-Ray Imaging Facility, The University of Manchester, UK
- October 2011 – November 2012 Visiting Academics, Microscale numerical modeling of mechanical response of equiaxed crystals during solidification Department of Materials, Imperial College London, UK
- September 2010 – March 2012 Consultant, Developing models of microstructures during casting of materials for energy applications, GE Global Research, USA
- April 2010 – September 2011 Research Associate, Mechanical Fragmentation of Dendrites in Equiaxed Partially Solid Alloys, Imperial College London, UK

October 2006 PhD Candidate, Measurement and Control of Electrical Phenomena during Vacuum Arc
– April 2010 Remelting (VAR) for Optimal Material Quality, Imperial College London, UK

HONORS AND AWARDS

2018 **Best Paper Winner**, Manufacturing USA, MSEC 2018, USA

2017 **Excellent Review Recognition**, Metallurgical and Materials Transactions, TMS, USA

2017 **Patent Innovation Award**, GE Global Research, US

2016 **Extraordinary Performance Recognition Award**, GE Global Research, US

2012 **Young Researcher's Award**, The IChemE Particle Technology Subject Group and Royal Society of Chemistry Particle Characterization Group, UK

2011 **McLean Medal Award**, Imperial College London, UK

2009 **Andrew Carnegie Research Fund**, UK

2009 **Student Sponsor Awards** by MAGMA Giessereitechnologie GmbH, UK

2007 – 2009 **UK Overseas Research Students Awards**, UK

2006 – 2009 **UK EPSRC Fellowship**, UK

2003 **Excellent Graduate**, Tsinghua University, China

GOVERNMENT GRANTS

2016 – 2018 **Principle Investigator**, Virtually Guided Certification (15-07-05): From art-to-part: multidisciplinary virtual toolset for laser powder bed fusion additive manufacturing and multi-step post processing certification, DMDII, Collaboration with University of Cincinnati, University of Illinois at Urbana–Champaign and TechSolve

2016 – 2017 **Principle Investigator**, HPC4Mfg: Process map for tailoring microstructure in laser powder bed fusion additive manufacturing, DoE, Collaboration with Oak Ridge National Laboratory

2017 – 2018 **Principle Investigator**, HPC4Mfg: Powder spreading process maps for metal additive manufacturing, DoE, Collaboration with Oak Ridge National Laboratory

PROFESSIONAL AFFILIATIONS & SERVICES

2018 – Present **JOM Advisor**, Solidification Committee, TMS, USA

2017 **Organizing committee**, Modeling of Powder Dynamics in Metal Additive Manufacturing, Advanced Manufacturing Office, DoE

2017	Organizer and Session Chair , Advances in Modelling on Additive Manufacturing, ASM Symposium, ASM International
2017 – 2018	Organizer and Session Chair , TMS Annual Meeting: Application of Solidification Fundamentals to Challenges in Metal Additive Manufacturing, TMS, USA
2017 – Present	Committee member of Solidification Division , TMS, USA
2017 – Present	Committee member of Additive Manufacturing Division , TMS, USA
2017 – Present	Committee member at Verification and Validation of Computational Modelling in Energy Systems, ASME, USA
2016 – Present	Editorial Board Member , Journal of Smart and Sustainable Manufacturing Systems, ASTM International, USA
2010 – Present	Active Reviewer for Top Journals in Materials Science and Engineering, and Manufacturing , e.g. Acta Mater.; Modelling Simu. Mat. Sci. Eng.; JOM; Metal Mater Trans A & B.; Comp. Mater. Sci.; J Manuf. Sci. Eng.; J Sustainable Metal.
2012	Chairman , the 14 th Chinese Materials Association in UK(CMA-UK) Conference, UK
2010	Deputy Chair , the 13 th Chinese Materials Association in UK(CMA-UK) Conference, Leicester, UK

INVITED TALKS

2017	Numerical Models in Additive Manufacturing and Their Needs, SSRL/LCLS Annual Users' Meeting, Menlo Park, CA
2017	Casting Defect Prediction Leveraging the Digital Thread to Optimize Manufacturing, TMS2017 Annual conference, San Diego, CA
2016	Additive Manufacturing at GE, MIT workshop on experimental and computational fracture mechanics, Boston, MA
2010	Multiscale Modelling of the Influence of Convection on Dendrite Formation and Freckle Initiation during Vacuum Arc Remelting, GE Global Research, Niskayuna, NY

PATENTS

2016	Control of solidification in laser powder bed fusion additive manufacturing using a diode laser fiber array, US 20160158889 A1
Filed	Dynamic shaping of laser beam profile for control of microstructure in metal Additive Manufacturing
Filed	Scan strategy for efficient utilization of laser arrays in Direct Metal Laser Melting

Filed	Simultaneous functional generation of Direct Metal Laser Melting scan path - swept scan path generation
Filed	Method for generating Direct Metal Laser Melting scan path using thermal and strain modeling
Filed	Systems and methods for controlling microstructure of additively manufactured components
Filed	Systems and methods for additive manufacturing rotating build platforms
Filed	Methods for controlling surface finish and throughput by controlling Additive scan path parameters
Filed	Systems and methods for fabricating a component with at least one laser device
Filed	Systems and methods for additive manufacturing recoating
Filed	Method of mechanical milling for enhanced properties

PUBLICATIONS

Peer-reviewed journal articles

1. An, K., **Yuan, L.**, Dial, L., Spinelli, I., Stica A.D., and Gao, Y. Non-destructive residual stress measurement and finite element simulation in thin-walled structure by laser powder bed fusion additive manufacturing, ***Materials & Design***, 2017, vol 135, 122-132.
2. Mills, K. C., Karagadde, S., Lee,P.D., **Yuan, L.** and Shabhzian, F., Calculation of physical properties for use in models of continuous casting process: Part 1 mould slags, ***ISIJ international***, 2016, vol 56, 274-281.
3. Mills, K. C., Karagadde, S., Lee,P.D., **Yuan, L.** and Shabhzian, F., Calculation of physical properties for use in models of continuous casting process: Part 2 steels, ***ISIJ international***, 2016, vol 56, 264-273.
4. Prasad A., **Yuan L.**, Lee P.D. Easton M., and StJohn D., On the solute diffusion length in the interdependence model: dendritic versus non-dendritic interface, ***Materials Science Forum***, 2015, v828, pp 461-467
5. Karagadde S., **Yuan L.**, Shevchenko N., Eckert S. and Lee P.D., 3-D microstructural model of freckle formation validated using in situ experiments, ***Acta Materialia***, 2014, vol 79, pp 168-180
6. Cai B., Karagadde S., **Yuan, L.**, Marrow T.J., Connolley T. and Lee P.D., In situ synchrotron tomographic quantification of granular and intragranular deformation during semi-solid compression of an equiaxed dendritic Al–Cu alloy, ***Acta Materialia***, 2014, vol 76, pp 371-380.
7. Miller J.D., **Yuan L.**, Lee P.D. and Pollock T.M., Simulation of diffusion-limited lateral growth of dendrites during solidification via liquid metal cooling, ***Acta Materialia***,

2014, vol 69, pp 47-59.

8. Zhang Z., **Yuan L.**, Lee P.D., Jones, E. and Jones, J. R., Modeling of time dependent localized flow shear stress and its impact on cellular growth within additive manufactured titanium implants, ***Journal of Biomedical Materials Research Part B: Applied Biomaterials***, 2014, 2014:00B:1–11.
9. Gourlay, C.M., O’Sullivan, C., Fonseca J., **Yuan L.**, Kareh, K.M., Nagira T. and Yasuda H., Synchrotron Radiography Studies of Shear-Induced Dilation in Semisolid Al Alloys and Steels, ***JOM***, 2014, vol 66, pp 1415-1424
10. Pericleous K., Djambazov G., Ward, M., **Yuan L.**, and Lee P. D., A Multiscale 3D model of the Vacuum Arc Remelting process, ***Metallurgical and Materials Transactions A***, 2013, vol 44, pp 5365-5376.
11. Prasad A., **Yuan L.**, Lee P.D. and StJohn D., Interdependence Theory of grain nucleation: A numerical analysis, ***Acta Materialia***, 2013, vol 61, pp 5914-5927
12. Mills K.C, **Yuan L.**, Li Z and Zhang, G H., Estimating viscosities, electrical and thermal conductivities of slags, ***High Temperature-High Pressure***, 2013, v42, pp 237-256
13. Prasad A., **Yuan L.**, Lee P.D. and StJohn D., Improvement of the Interdependence analytical model through selection of interfacial growth rates during the initial transient, ***Materials Science Forum***, 2013, v765, pp 77-81
14. **Yuan L.** and Lee P. D., A New Mechanism for Freckle Initiation Based on Microstructural Level Simulation, ***Acta Materialia***, 2012, vol 60, pp 4917–4926
15. **Yuan L.**, O’Sullivan C. and Gourlay C.M., Exploring Dendrite Coherency with the Discrete Element Method (DEM), ***Acta Materialia***, 2012, vol 60, pp 1334-1345.
16. **Yuan L.** and Lee P. D., Numerical Simulations on Dendritic Solidification under Forced and Natural Convection for Binary Alloys: 2D vs. 3D, ***Modelling and Simulation in Materials Science and Engineering***, 2010, vol. 18, pp. 055008. (Cover paper)
17. Mills, K.C, **Yuan, L.**, Li, Z, Zhang, G H and Chou, K. C. A Review of the Factors Affecting the Thermophysical Properties of Silicate Slags, ***High Temperature Materials and Processes***, 2012, vol 31, pp 301-321.
18. Mills K. C., **Yuan L.** and Jones R. T., Estimating the Physical Properties of Slags, ***The Journal of The Southern African Institute of Mining and Metallurgy***, 2011, vol. 111, pp 649-658.
19. **Yuan L.** and Lee P. D., Microstructural simulations of the influence of solidification velocity on freckle initiation during directional solidification, ***ISIJ International***, 2010, vol. 50, pp. 1814-1818.
20. **Yuan L.**, Lee P. D., Djambazov G. and Pericleous K., Numerical Simulation of the Effect of Fluid Flow on Solute Distribution and Dendritic Morphology, ***International Journal of Cast Metals Research***, 2009, vol. 22, pp. 204-208.
21. **Yuan L.**, Djambazov G., Lee P. D. and Pericleous K., Multiscale Modelling of the

- Vacuum Arc Remelting Process for the Prediction on Microstructure Formation, *International Journal of Modern Physics B*, 2009, vol. 23, Nos. 6&7, pp. 1584-1590.
22. **Yuan L.**, Yang, J., Xiong, S.-M. and Liu B.-C., A Water Analogue Validation of A Numerical Simulation Model of Metal Flow in the Slow Shot Phase of the Die Casting Process, *International Journal of Cast Metals Research*, 2008, vol. 21, pp. 410-407.
 23. **Yuan L.**, Xiong, S.-M. and Liu B.-C., 3D Numerical simulation of temperature Field Coupled Flow Field of the Liquid Metal in the Shot Sleeve of Die Casting Process, *Special Casting and Nonferrous Alloys*, 2005, vol.25, pp. 590-595.
 24. Yang J., **Yuan L.**, Xiong, S.-M. and Liu B.-C., Numerical Simulation on the Liquid Metal Flow of the Acceleration Phase in the Shot Sleeve of Cold Chamber Die Casting Process, *Materials Science Forum*, 2007, vol 561, pp. 1801-1804.
 25. Yang J., **Yuan L.** and Xiong, S.-M., Study on the Effects of the Slow Shot Phase on the Flow Patterns of Die Casting Mold Filling Process, *Foundry*, 2007, vol 56, pp. 622-625.
 26. Wang G., **Yuan L.**, Xiong, S.-M. and Liu B.-C., Numerical simulation of flow field of the slow shot phase in the shot sleeve, *Foundry*, 2004, vol.53, pp. 909-913.

Edited Volumes and Conference Papers

27. Prasad A., **Yuan L.**, Lee P.D., Easton M. and St John D., The effect of the melt thermal gradient on the size of the constitutionally supercooled zone, IOP Conference Series: Materials Science and Engineering, 2016, vol 117, 012001.
28. **Yuan L.**, Makinde A., Cater W.T., Chaudhary, A. and Keller M., Simplified approach for modeling of distortion in powder bed fusion processes, Society for the Advancement of Material and Process Engineering (SAMPE), 2014, 325-334.
29. Prasad A., **Yuan L.**, Lee P.D. and StJohn D., Modelling of the Nucleation-Free Zone Formed during the Initial Transient of Grain Formation, TMS2013 Proceeding, 2013, pp 501-508.
30. **Yuan L.**, O'Sullivan C. and Gourlay C.M., Numerical Study of Dendrite Coherency during Equiaxed Solidification by The Discrete Element Method, IOP Conference Series: Materials Science and Engineering, 2012, 33, 012071
31. Mills K.C, **Yuan L.** ,Li Z., and Zhang G.H., Estimating the electrical & thermal conductivities of slags, Proceedings of International Congress on the Science and Technology of Steelmaking, 2012
32. Mills K.C, **Yuan L.**, Li Z., Chou K C and Zhang G.H., The factors affecting the thermophysical properties of slags and glasses, Proceedings of Ninth International Conference on Molten Slags, Fluxes and Salts, 2012

33. **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., Multiscale Modelling of The Onset of Freckle Formation during Vacuum Arc Remelting , In: Williamson R., Lee P. D. and Mitchell A., editors, Proceeding of Liquid Metal Processing and Casting, Santa Fe, NM, US, 2009, pp. 39-46.
34. **Yuan L.**, Lee P. D., Djambazov G. and Pericleous K., Three-Dimensional Simulation of the Influence of Convection on Dendritic Solidification, In: Cockcroft S. and Maijer D., editors, Modelling of Casting, Welding and Advanced Solidification Processes XII, Canada, 2009, pp. 451-458.
35. **Yuan L.**, Djambazov G., Pericleous K. and Lee P. D., Multiscale Modelling of Dendrite Growth during Vacuum Arc Remelting, In: Lee P. D., Mitchell A., Jardy A. and Bellot J. P., editors, Proceeding of Liquid Metal Processing and Casting, Nancy, France, 2007, pp. 43-48.
36. **Yuan L.**, Xiong, S.-M. and Liu B.-C., Numerical Simulation and Optimization of the Liquid Metal Flow in the Shot Sleeve of Cold Chamber Die Casting Process. In: Gandin C-A., Bellet M., editors, Modeling of Casting, Welding and Advanced Solidification Processes XI, France, 2006, pp. 111-118.

CONFERENCES AND TALKS

June 2018	Yuan, L., Anand, S., Chaudhuri, S. Moehring, S., “Multidisciplinary Virtual Toolset for Laser Powder bed Fusion Additive Manufacturing and Multi-Step Post Processing Certification”, MSEC 2018 , College Station, Texas
March 2018	Yuan, L., Anand, S., Chaudhuri, S. Moehring, S., “From Art-to-part: Multidisciplinary Virtual Toolset for Laser Powder bed Fusion Additive Manufacturing and Multi-Step Post Processing Certification”, TMS 2018 147th Annual Meeting & Exhibition , Phoenix, AZ
March 2018	StJohn, D., Prasad, A., Yuan, L., Lee P.D., “Simulating Grain Formation during Metal Additive Manufacturing (AM): Potential Pathways for Producing Equiaxed Grain Structures”, TMS 2018 147th Annual Meeting & Exhibition , Phoenix, AZ
March 2018	Sabau, A., Yuan, L., Simunovic, S., Turner, J., Carlson, N., “Fluid Dynamics Effects on Microstructure Prediction in the Laser Additive Manufacturing Process” TMS 2018 147th Annual Meeting & Exhibition , Phoenix, AZ
March 2017	Yuan, L. , “Casting defect prediction leveraging the Digital Thread to Optimize Manufacturing”, TMS 2017 146th Annual Meeting & Exhibition , San Diego, CA

- March 2015 Karagadde, S., **Yuan, L.**, Lee, P. D. "A 3D Numerical Investigation of the Influence of Casting Defects on Channel Segregates" **TMS 2017 144th Annual Meeting & Exhibition**, Orlando, FL
- July 2015 Prasad, A., **Yuan, L.**, Lee, P. D., Easton, M. and StJohn, D. "On the solute diffusion length in the Interdependence Model: Dendritic versus non-Dendritic interface", **Light Metals Technology** 2015, South Africa
- July 2014 Prasad, A., **Yuan, L.**, Lee, P. D., Easton, M. and StJohn, D. "The effect of the melt thermal gradient on the size of the constitutionally supercooled zone, on the **4th International Conference on Advances in Solidification Processes**, Windsor, United Kingdom
- July 2013 Prasad, A., **Yuan, L.**, Lee, P. D., and StJohn, D. "Improvement of the interdependence analytical model through selection of interfacial growth rates during the initial transient." On **Light Metals Technology** 2013, Old Windsor, United Kingdom
- March 2013 **Yuan L.**, Shevchenko N., Eckert S., Karagadde S., Lee P. D., "Microscopic Modelling of Freckle Formation during Directional Solidification and Its Verification Via In Situ X-Ray Observation", on **TMS 2013 142nd Annual Meeting & Exhibition**, Texas, US.
- March 2013 Prasad A., **Yuan L.**, Lee P. D., StJohn D., "Modelling of the Nucleation-Free Zone Formed during the Initial Transient of Grain Formation", on **TMS 2013 142nd Annual Meeting & Exhibition**, Texas, US.
- March 2013 Lee P. D., **Yuan L.**, Puncreobutr C., "In Situ Fast Synchrotron Tomography to Inform and Validate Microstructural Models", on **TMS 2013 142nd Annual Meeting & Exhibition**, Texas, US. (Invited)
- October 2012 Lee P. D., **Yuan L.** and Puncreobutr C., "Predicting Microstructure-Property Relationships in Structural Materials via Multiscale Models Validated By In-Situ Synchrotron Observation", on **Harnessing the Materials Genome: Accelerated Materials Development via Computational and Experimental Tools**, Colorado, US (Invited)
- October 2012 Mills K.C., Yuan L., Li, Z. and Zhang G.H., "Estimating the electrical & thermal conductivities of slags", on **5th International Congress on the Science and Technology of Steelmaking** 2012, Dresden, Germany.
- June 2012 **Yuan L.**, O'Sullivan C. and Gourlay C.M., "Numerical Study of Dendrite Coherency during Equiaxed Solidification by The Discrete Element Method", on **Modelling of Casting, Welding and Advanced Solidification Processes XIII**, Schladming, Austria.
- May, 2012 Mills K.C., **Yuan L.**, Li Z., Chou K.C., and Zhang G.H., The Factors Affecting Various Thermophysical Properties of Slags and Glasses, on the **9th International Conference on Molten Slags, Fluxes and Salts**, Beijing, China.

- April 2012 **Yuan L.** O' Sullivan C., Gourlay C. M., "A Study of The Packing of Complex Shape Crystals Using The Particulate Discrete Element Method during Equiaxed Solidification", on the **11th UK Particle Technology Forum**, Loughborough, UK.
- March 2012 **Pericleous K.**, Djambazov, G., Ward M. **Yuan L.**, and Lee P., "*A Multi-Scale 3D Model of the Vacuum Arc Remelting Process*", on **TMS 2012 141st Annual Meeting & Exhibition**, Florida, US.
- November 2011 **Yuan L.** **High-level International Symposium on Cutting-edge Technology of Digital Design and Manufacturing**, Beijing, China. (Invited Participant)
- June 2011 **Yuan L.** O' Sullivan C., Gourlay C. M., "*Exploring Dendrite Coherency with the Discrete Element Method*", on the 3rd **International Conference on Advances in Solidification Processes**, Aachen, Germany.
- March 2011 **Yuan L.** and Lee P. D., "*Microstructural Level Modelling of Freckle Initiation during Directional Solidification*", on **TMS 2011 140th Annual Meeting & Exhibition**, San Diego, US. (Invited)
- March 2011 Miller J., **Yuan L.**, Eisman M., Lee P., and Pollock T., "Heat Extraction and Structure Evolution in LMC Single-Crystal Growth", on **TMS 2011 140th Annual Meeting & Exhibition**, San Diego, US. (Invited)
- September 2010 Djambazov G., Pericleous. K, Ward R.M., **Yuan L.** and Lee P. D., "*A Multiscale 3D Model of the Vacuum Arc Remelting process*" on **OPTIMoM: Optimising Performance through Integrated Modelling of Microstructure**, Cambridge, UK.
- February 2010 **Yuan L.** and Lee P. D., "*Numerical Simulation of the Onset of Freckle Formation in Directionally Solidified Pb-Sn Alloys on the Microstructure Level*" on 2nd International Symposium on **Cutting Edge of Computer Simulation of Solidification and Casting**, Sapporo, Japan. (Invited)
- September 2009 **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., "*Multiscale modelling of the tendency of freckling in VAR*" on International Symposium on **Liquid Metal Processing and Casting**, Santa Fe, NM, US.
- September 2009 **Yuan L.** and Lee P. D., "*Numerical simulation of the onset of freckle formation during directional solidification on the microstructure level*" on **Euromat 2009 – European Congress and Exhibition on Advanced Materials and Processes**, Glasgow, UK.
- August 2009 **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., "*Multiscale modelling of microstructure formation and the prediction of freckling in VAR*" on **CCMX Summer School on Modelling in Materials Science**, Lausanne, Switzerland.
- June 2009 **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., "*Three dimensional simulation of the influence of convection on dendritic solidification*" on **Modelling of Casting, Welding and Advanced Solidification Processes XII**, Vancouver, Canada.

- September 2008 **Yuan L.**, Djambazov G., Pericleous. K. and Lee P. D., “*Multiscale modelling of the VAR for the prediction on microstructure formation*” on the 5th **International Conference on Advanced Materials and Processing**, Harbin, China.
- July 2008 **Yuan L.**, Wang J. and Lee P. D., “*A multiscale model for predicting defects in casting*” on the 12th **CMA-UK Conference on Materials Science and Engineering**, Oxford, UK.
- June 2008 **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., “*Numerical simulation of the effect of fluid flow on solute distribution and dendritic morphology*” on the 2nd **International Conference on Advances in Solidification Processes**, Graz, Austria.
- March 2008 **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., “*Numerical simulation of dendritic growth with effects of fluid flow*” on **Corus – Academia Symposium**, Birmingham, UK.
- September 2007 **Yuan L.**, Lee P. D., Djambazov G. and Pericleous. K., “*Multiscale modelling of dendritic growth during VAR*” on International Symposium on **Liquid Metal Processing and Casting**, Nancy, France.
- May 2006 **Yuan L.**, **Xiong, S.-M.** and Liu B.-C., “*Numerical simulation and optimization of the liquid metal flow in the shot sleeve of cold chamber die casting process*” on **Modelling of Casting, Welding and Advanced Solidification Processes XI**, Opio, France.