个人简历

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兰司

LAN Si

南京理工大学格莱特纳米研究所

2016 年 09 月 21 日

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中子、同步辐射散射; 原位电镜

1. 目前研究职位

助理教授（2014 年 10 月-至今），南京理工大学 格莱特纳米研究所

2. 工作经历

副研究员、中子散射科技与技术中心执行主任（兼职）（2014 年 3 月-至今），香港城市大学深圳研究院

博士后研究员 （2012 年 11 月-2014 年 10 月），香港城市大学物理与材料科学系，导师：王循理教授 （2013 年牛津大学与卢瑟福散裂中子源暑期中子学校获得‘最佳研究提议奖’）。

3. 教育经历

时间	教育机构
2009 年 8 月-2012 年 10 月	博士， 材料科学与工程专业， 香港中文大学理学院物理系 学分绩点： 3.955/4.0 导师：大块金属玻璃创始人 KUI H W **杨振宁奖（2012 年度在香港中文大学仅奖励三名研究生）**
2007 年 9 月-2009 年 6 月	工学硕士，材料加工工程专业，武汉大学材料工程系 学分绩点： 3.90/ 4.00 **支部书记**，被授予武汉大学动力与机械学院**优秀共产党员**
2003 年 9 月-2007 年 6 月	工学学士，材料科学与工程专业，成都理工大学材料科学与工程系 学分绩点： 3.94/4.0 **学生会主席，于 160 名同学中排名第一，被授予四川省优秀毕业生，四川省优秀学生干部，四川省大学生综合素质 A 级证书、全国挑战杯创业大赛铜奖**

4. 项目基金

目前主持国家自然科学基金青年基金和校自主科研专项国际合作专项各一项；参与国家自然科学基金面上项目多项及国际合作重大专项；科技部“大科学装置前沿研究”重点专项“中子散射样品环境及相关实验技术”课题骨干成员

5. 社会兼职及荣誉

江苏省“双创博士”人才计划；

2016-2017 年 Gordon Research Seminars of Neutron Scattering（高登研讨会中子散射分会）主席；

MRS、TMS，香港物理学会会员; Intermetallic、Journal of Materials Science 等杂志审稿人

6. 学术文章

已经发表的文章

(1) **Lan S**, Blodgett M, Kelton K F, et al. Structural crossover in a supercooled metallic liquid and the link to a liquid-to-liquid phase transition[J]. Applied Physics Letters, 2016, 108(21): 211907.

(2) **Lan S**, Wei X, Zhou J, et al. In-situ study of crystallization kinetics in ternary bulk metallic glass alloys with different glass forming abilities[J]. Applied Physics Letters, 2014, 105(20): 201906.

(3) **Lan S**, Yip Y L, Lau M T, et al. Direct imaging of phase separation in Pd 41.25 Ni 41.25 P 17.5 bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2012, 358(10): 1298-1302.

(4) **Lan S**, Lau M T, Kui H W. The time constant of the spinodal decomposition in Pd 41.25 Ni 41.25 P 17.5 bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2013, 361: 1-8.

(5) **Lan S**, Wu Z D, Lau M T, et al. Crystallization in homogeneous and phase-separated Pd 41.25 Ni 41.25 P 17.5 bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2013, 373: 5-12.

(6) **Lan S**, Blodgett M, Kelton K F, et al. Liquid-to-liquid phase transition underlying the structural crossover in a supercooled metallic liquid[J]. arXiv preprint arXiv:1509.03394, 2015.

(7) Jiao W, Wang X L, **Lan S**, et al. Propensity of bond exchange as a window into the mechanical properties of metallic glasses[J]. Applied Physics Letters, 2015, 106(6): 061910.

(8) Lau M T, **Lan S**, Yip Y L, et al. A metastable liquid state miscibility gap in undercooled Pd‐Ni‐P melts[J]. Journal of Non-Crystalline Solids, 2012, 358(18): 2667-2673.

(9) Huang Y, Kin W K, **Lan S**, et al. Observation of distinct atomic relaxation process in a phase-separated metallic glass-forming melt[J]. EPL (Europhysics Letters), 2014, 108(4): 46001.

(10) Wu Z D, Zhou W Z, Lo Y F, et al. On the short-range orders in spinodal Pd‐Ni‐P bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2015, 410: 51-57.

(11) Wu Z D, **Lan S**, Kui H W. Crystallization of Phase-Separated Pd41. 25Ni41. 25P17. 5 BMGs[J]. Metallurgical and Materials Transactions A, 2014, 45(5): 2399-2404.

(12) Pramanick A, Jørgensen M R V, Diallo S O, Christianson A D, Fernandez‐Baca J A, Hoffmann C, Wang X, **Lan S**, Wang X-L. Ferroelectric Materials: Nanoscale Atomic Displacements Ordering for Enhanced Piezoelectric Properties in Lead‐Free ABO3 Ferroelectrics (Adv. Mater. 29/2015)[J]. Advanced Materials, 2015, 27(29): 4329-4329.

(13) Wu Z D, **Si Lan**, Hin Wing Kui, Crystallization of phase separated BMGs, **TMS2013 Supplemental Proceedings**, Part III: Bulk Metallic Glasses X, 2013, 266: 259-266.

(14) Xiao W K, Han C C, **Lan S,** Ruan X F. Effect of electrical pulse on dynamic crystallization of ferrite and properties High-Carbon Chromium steel, The 2nd International Conference on Mechanic Automation and Control Engineering **(MACE 2011) Proceeding**, July, 2011.

(15) Fan T T, Xiao W K, Li L, **Lan S**, Li X T, "Research of Cr1-xMxN's (M=Al,V,Ti,etc.,x=0.5) Coating Valence Electron Structure Calculation and Wear-Resisting Performance", Advanced Materials Research, 2013, 706-708: 238-243.

(16) 贾希光，陈善华，陶乔，**兰司，**杨希. 镁合金表面二氧化铈薄膜的制备及其性能. **材 料保护**，中国，4，2009.

(17) **兰司，**张周全，管登高. 单层宽频 Ni 基电磁波屏蔽复合材料模型建立及其性能研究. **中国科技博览**，中国，24，2008.

正投稿的文章

(1) **Si Lan,** Xun-li Wang**,** et al., liquid-to-liquid phase transition in a supercooled glass-forming metallic liquid, Nature Communications, Under review, 2016.

(2) **Si Lan,** Xun-Li Wang, et al., In-situ studies of transition of classic to avalanche nucleation in Zr-Cu-Al bulk metallic glasses and the correlation with glass-forming ability, Submitted to Acta Materialia, 2016.

(3) Xuelian Wu, **Si Lan,** et al., Probing atomic-to-nanoscale structures of Zr-based binary metallic glasses and the correlation with glass-forming ability, Journal of Alloys and Compounds, Under review, 2016.

(4) M Naeem, **Si Lan** et al., Suppression of crystallization in Ca-based bulk metallic glass under compression, Submitted to Scripta Materialia, 2016.

7. 会议发表

(1) **Si Lan, Xiaoya Wei,** Jie Zhou, Zhaoping Lu, Jörg Neuefeind, Tao Feng, Xun-Li Wang, In-situ neutron scattering study of phase stability in BMGs and nanoglasses, Oral presentation, BMG XI, St. Louis, USA, 2016.（国际会议口头报告）

(2) M Naeem, **Si Lan** et al., Suppression of crystallization in Ca-based bulk metallic glass under compression. Hong Kong Physics Society annual meeting, Hong Kong, 2016 July. (口头报告)

(3) **Si Lan, Xiaoya Wei,** Jie Zhou, Zhaoping Lu, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of transition of crystallization pathways in ternary bulk metallic glasses, Oral presentation, America Materials Research Society (MRS) 2015 fall meeting, Boston, MA, USA, 2015. （国际会议口头报告）

(4) **Si Lan**, et al. Liquid-to-liquid phase transition underlying the structural crossover in a supercooled metallic liquid, Gordon Research Conference on Neutron Scattering, Presentation, Hong Kong, 2015.

(5) Si Lan, Xiaoya Wei, Jie Zhou, Zhaoping Lu, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of transition of crystallization pathways in ternary bulk metallic glasses, Oral presentation, **Asia-Oceania Neutron Scattering Associatio**n 2015 annual meeting, Sydney, Australia, 2015 July. （国际会议口头报告）

(6) 兰司，王循理，等，液体和非晶软磁合金结构的原位散射研究，基金委及非晶联盟液体结构研讨会，合肥工业大学，合肥，2015.（口头报告）

(7) 兰司，王循理，等，原位小角中子散射在金属玻璃中的应用，散裂中子源小角散射线站高端用户会议，中国散裂中子源，广东东莞，2015.（口头报告）

(8) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering study of crystallization kinetics in ternary bulk metallic glasses, Invited oral presentation, TMS 2014 annual meeting & exhibition, San Diego, USA, 2014.（国际会议邀请报告）

(9) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ study of crystallization kinetics and its correlation to glass-forming ability for ternary bulk metallic glasses, Oral presentation, BMG X, Shang Hai, China, 2014.（国际会议口头报告）

(10) **Si Lan,** Yeuk Lan Yip, Man Tat Lau, Hin Wing Kui, Amorphous phase separation in a bulk metallic glass with negative heating of mixing, Oral presentation, TMS 2012 Annual meeting & exhibition, Orlando, FL, USA. （国际会议口头报告）

(11) **Si Lan,** Amorphous phase separation in a bulk metallic glass of negative heat of mixing, invited oral presentation, City University of Hong Kong, Hong Kong, 2013. （邀请报告）

(12) **Si Lan,** Jie Zhou, Zhaoping Lu, Xun-Li Wang, In-situ neutron scattering study of crystallization kinetics in ternary bulk metallic glasses, Oral presentation, Hong Kong Physics Society 2013 annual meeting, Chinese University of Hong Kong, Hong Kong, 2013. （邀请报告）

(13) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of crystallization kinetics in ternary bulk metallic glasses, Oral presentation, America Materials Research Society (MRS) 2013 fall meeting, Boston, MA, USA, 2013. （国际会议口头报告）

(14) **兰司,** 魏小雅, 吴雪莲, 周捷, 吕昭平, Mikhail Feygenson, Jörg Neuefeind, 王循理, 三元大块金属玻璃结晶动力学的原位中子和透射电子显微镜研究，口头演讲， 第一届中国散裂中子源用户会议，中国广东东莞，2013 年 12 月 （口头演讲）

(15) Man Tat Lau, **Si Lan,** Yeuk Lan Yip, Hin Wing Kui, Determination of Phase Separation in Amorphous $Pd_{(40+0.5x)}Ni_{(40+0.5x)}P_{(20-x)}$ BMG for x = 0 to 4, Co-author, TMS 2012 Annual meeting & exhibition, Orlando, FL, USA.（国际会议口头报告）

(16) Zhen Duo Wu, **Si Lan,** Hin Wing Kui, Crystallization of phase separated $Pd_{41.25}Ni_{41.25}P_{17.5}$ BMGs, Co-author, TMS 2013 Annual meeting & exhibition, San Antonio, TX, USA. （国际会议口头报告联合作者）

8. 研究访问及海外实验经历

- 2016 年七月，访问**美国阿贡国家实验室先进同步辐射光源** 1-ID-E 线站开展金属玻璃高温塑性变形的原位同步广角衍射/小角散射研究；
- 2015 年十一月，访问**美国阿贡国家实验室先进同步辐射光源** 1-ID-E 线站开展金属玻璃液体结构动力学演变的原位同步辐射散射研究；
- 2015 年九月，访问**日本北海道大学电子显微镜中心利用高压透射电子显微镜和球差透射电子显微镜**开展金属玻璃液体结构的原位研究；
- 2015 年八月，访问**美国阿贡国家实验室先进同步辐射光源** 11-ID-C 线站开展钙基金属玻璃高温塑性变形的原位同步辐射散射研究；
- 2015 年七月，访问**澳大利亚中子源 ANSTO** 的 QUOKKA 小角散射线站开展金属玻璃液态相变及结晶的原位研究；
- 2014 年十一月，**访问日本原子能机构散裂中子源 J-Parc 的 NOVA 线站**开展金属玻

璃声子散射谱的非弹性中子散射测量；然后于 2015 年 3 月赴 NOVA 进行非弹性散射实验数据处理。

- 2014 年五月，访问**美国橡树岭国家实验室散裂中子源** NOMAD 谱仪开展大块非晶合金结晶动力学原位中子散射研究；
- 2014 年三月，访问**美国阿贡国家实验室先进同步辐射光源** 11-ID-C 线站开展液态合金结构动力学原位同步辐射散射研究；
- 2013 年十一月，访问**美国华盛顿大学圣路易斯 Ken Kelton 教授研究组**，展开基于静电悬浮装置的金属液滴的热物理参数和内部结构研究；
- 2013 年九月，访问英国牛津大学圣安书院并参加**英国牛津大学与 ISIS 散裂中子源**举办的第十三届牛津中子散射学校（13th **Oxford School on Neutron Scattering**）同时赢得了研究提议大赛的“**最佳研究提议奖**”；
- 2013 年七月，访问**美国阿贡国家实验室先进同步辐射光源** 11-ID-C 线站开展谱仪开展大块非晶合金结晶动力学原位同步辐射散射研究；
- 2013 年六月，访问**美国阿贡国家实验室先进同步辐射光源** 6-ID-D 线站开展基于同步辐射线站静电无重力悬浮装置的液态结构研究；
- 2013 年五月，访问**美国橡树岭国家实验室散裂中子源** NOMAD 谱仪开展大块非晶合金结晶动力学原位中子散射研究；
- 2013 年四月，访问**北京科技大学新金属国家重点实验室**开展三元大块金属玻璃的制备研究；
- 所写的研究提议多次被**美国橡树岭国家实验室散裂中子源、澳洲中子源、日本散裂中子源、美国阿贡国家实验室先进同步辐射光源 1-ID-C**、11-ID-C 等批准。

9. 主要研究过的课题简介

9.1 复杂材料相变动力学的中子和同步辐射散射研究(2012 年 11 月-现在, 现阶段（包括博士后阶段）研究)

我们针对大块金属玻璃等复杂材料相变过程中结构的变革展开了一系列原位中子/同步辐射散射以及原位透射电子显微镜的研究，以期获得相变过程最直接的结构证据。通过跟一批国际最顶尖的科学家合作，如 Ken Kelton 教授，Yang Ren 博士等，运用国内外知名的中子和同步辐射装置，包括美国橡树岭国家实验室的裂变中子源（SNS），美国阿贡国家实验室的同步辐射光源（APS），位于牛津郡的卢瑟福·阿普尔顿实验室中子源（ISIS），位于日本的同步辐射源（Spring8）以及中子源（J-PARC）等。相关文章已经投完国际高水平刊物（自然子刊等）。

- **三元大块金属玻璃结晶动力学的原位中子和同步辐射散射研究**

研究大块金属玻璃（BMG）的结晶动力学是确定其玻璃形成能力（GFA）本质的最直接有效的方法。然而，多元合金的复杂化学组成阻碍了对其结晶物理机制的研究进程，所以简化其化学组成十分重要。我们通过使用实时的原位中子/同步辐射散射以及透射电子显微镜技术，研究了两种简单化学组成的大块三元合金 $Zr_{56}Cu_{36}Al_8$ 和 $Zr_{46}Cu_{46}Al_8$ 的结晶动力学过程。$Zr_{46}Cu_{46}Al_8$ 合金具有较优异的 GFA。原位中子散射实验是在美国橡树岭国家重点实验室(ORNL)的散裂中子源（SNS）纳米尺度有序材料衍射仪（NOMAD）上完成的。这些大块金属玻璃从非晶到晶体的转变的结构演变过程已经被完好的记录下来。结果证明，两种玻璃形成合金的结晶动力学过程截然不

同，且中程和长程有序在 $Zr_{46}Cu_{46}Al_8$ BMG 中比在 $Zr_{56}Cu_{36}Al_8$ BMG 中更难发展。研究结果发表于国际权威刊物（Appl. Phys. Lett., Acta Mater. 等）

- **基于同步辐射静电悬浮装置的玻璃形成液体合金液态相变结构演变的研究**
  金属液体的物理本质已经吸引了越来越多的关注，因为其直接决定了大块金属玻璃的结构稳定性和玻璃形成能力。然而因为异质形核的存在，结晶的干扰导致过冷合金重要温度区间的物理研究几乎无法进行，从而使亚稳的过冷液体重要的物理参数以及结构信息都无法获得。为了探寻金属液体在加热和冷却过程中的结构演变和物理参数（如比体积等）的变化，运用安装在美国先进光源的静电悬浮装置，我们对具有优异玻璃形成能力的合金液体进行了研究。我们获得了液态 VIT106 锆基合金在温度变化过程中液态相变的直接结构证据。相关结果将被投往 Phys. Rev. Lett.。我们还获得了美国阿贡实验室先进光源线站 11-ID-C 的研究资助，已经于 2014 A 阶段进行了进一步的研究。

9.2 纳米玻璃的中子和同步辐射散射原位研究(2014 年 10 月-现在, 现阶段研究)

运用中子和同步散射技术，包括广角衍射和小角散射等，研究了脉冲电沉积制备的 Ni-P 纳米非晶合金的界面结构及其热稳定性，同时通过原位电镜力学测试技术，揭示了纳米非晶合金的独特力学性能。同步广角衍射和小角散射技术的证明了在 Ni-P 非晶纳米合金内部独特的原子堆积模式和纳米尺度的界面非均匀性，为揭示其独特的性能提供了重要参考。

9.3 大块金属玻璃的制备和相变动力学的研究(2009 年 8 月-2012 年 10 月, 博士阶段研究)

- **钯-镍-磷（$Pd_{41.25}Ni_{41.25}P_{17.5}$ ）块状金属玻璃相分离的透射电子显微镜直接影像**
  各组成元素的负混合热是合成大块金属玻璃的重要条件之一。具有负混合热的金属玻璃的非晶相分离现象是困扰学术界近四十年的一个课题。从 1969 年哈佛大学 D. Turnbull 组在负混合热 Pd-Si 系统提出非晶相分离以来，这个课题极具争议。一批科学家认为在金属玻璃系统不可能存在非晶相分离，这主要是因为缺乏辅以成分分析手段的直接影像证据。我在用玻璃提纯法制备到第一块大尺度金属玻璃的 Hin Wing Kui 教授组，基于 DSC、HRTEM、配备 HAADF 的 STEM，以及 EDS 成分分析工具，在所有合金元素之间都是负混合热的 $Pd_{41.25}Ni_{41.25}P_{17.5}$ 块状金属玻璃中观察到了波长为 50-100 nm 的相分离直接证据。在试验中我们运用了一种独特的热处理退火方式，同时我们提出在非晶 $Pd_{41.25}Ni_{41.25}P_{17.5}$ 中独特的短程有序结构将导致相分离的发生。这篇文章发表在非晶固态（Journal of Non-Crystalline Solids），相信将改变学术界对于液态金属内部短程有序结构的看法，对金属玻璃领域产生深远的影响。基于此文章的结果，Kui 博士研发了一系列**纳米网络状铁碳合金**，具有十分优异的力学性能。

- **过冷钯-镍-磷（Pd-Ni-P） 合金液体的亚稳液态混溶间隙**
  基于上述工作，我们系统的研究了 $Pd_{40+0.5x}Ni_{40+0.5x}P_{20-x}$ （x = 0 to 3.5） 块状金属玻璃的非晶相分离现象。当 $x \gtrsim 1$，相分离发生，反之则不发生。我们同时发现在相

分离样品内部测得的波长数据与相律恰好符合。实验结果表明，因为独特的短程有序结构的存在，在 Pd-Ni-P 合金体系中存在一个亚稳液态混溶间隙。相关的文章已经发表于非晶固态（Journal of Non-Crystalline Solids）。

- **钯-镍-磷（$Pd_{41.25}Ni_{41.25}P_{17.5}$ ）块状金属玻璃相分离的时间常数**
  根据 Cahn 的调幅分解理论，相分离需要时间来建立成分的调制。在这篇文章当中，我们研究了 $Pd_{41.25}Ni_{41.25}P_{17.5}$ 金属玻璃的相分离动力学过程。实验得到了 Pd-Ni-P 非晶合金中的相分离的时间常数。它很好的符合了深过冷液态 Pd-Ni-P 合金体系的扩散系数数据。相关的文章已经发表于非晶固态（Journal of Non-Crystalline Solids）。

- **钯-镍-磷（Pd-Ni-P） 体系金属玻璃的结晶动力学研究**
  通过研究不同热处理过程 Pd-Ni-P 块状非晶合金体系的结晶动力学，用透射电子显微镜数据很好的解释了 DSC 曲线上独特的吸热和放热峰。同时用透射电子显微镜直接研究了非晶相分离对后续结晶过程的影响，所建立的模型能为相关领域的后续研究提供很有价值的参考。一些成果已经发表于非晶固态（Journal of Non-Crystalline Solids），同时另有一些成果发表于 Metallurgical and Materials Transactions A、TMS2013 Supplemental Proceedings。另有一篇关于金属玻璃短程有序的文章将被投往一个 SCI 刊物。

- **锆基、钛基和铁基大尺度金属玻璃及纳米块状合金的熔炼制备**
  主要涉及电弧熔炼方法制备大块锆基、钛基和铁基金属玻璃及纳米块状合金。涉及力学性能和物理性能的测试，以期发现具有优异物理和力学性的金属玻璃和纳米块状合金的成分。

9.4 脉冲电流作用下高碳高铬合金钢塑性变形机制(2007 年 9 月-2009 年 6 月, 硕士毕业论文 课题)

高碳高铬的超硬合金钢冷变形十分困难，热变形的氧化现象十分严重。利用放电等离子烧结设备（SPS）产生的脉冲电流，结合有限元分析方法（ANSYS），通过透射电子显微镜的观察，研究了 9Cr18 合金钢的温变形现象。在此之前，科学界认为电塑性的主要原因是“电子风力”对位错的推动作用。但是我们实验发现相比于传统的加热方式，脉冲电流可以很好的促进动态回复和再结晶的发生，从而实现难变形合金的温变形。基于上述研究，我们提出了一种新的热加工工艺方法，对超硬合金的温变形具有很大的参考价值。

9.5 镍基单层宽频电磁波屏蔽复合材料的制备与工艺研究（2006 年 9 月-2007 年 6 月， 本科毕业论文课题）

制备单层宽频电磁波屏蔽复合材料的关键之一在于提高涂层的导电性能，减少空洞和间隙。针对 300KHZ-1.5GHz 频段电磁波屏蔽材料的要求，在大量研究电磁波屏蔽机理以及各个频段屏蔽效能影响因素的基础上，从微合金化多元复合的新思路出发，建立了单层宽频镍基电磁波屏蔽复合材料结构设计物理模型。经测试，

所制备的复合辅助填料／镍／丙烯酸树脂复合材料涂层厚度为 0.2-0.4ram，在 300KHz-1.5GHz 频段屏蔽效能可达 47-68dB，较镍／丙烯酸树脂复合材料涂层屏蔽效能提高了 21-31%，达到了国军标 GJB2604-96 标准。

10.实验技能

- 熟练掌握中子和同步辐射技术基本原理和实验方法；
- 熟练掌握中子和同步辐射散射实验数据的分析处理方法(Fit2d, PDFgetX2, PDFgetX3, batch processing software of WU-BESL, GSAS, DAVE etc.)；
- 基于玻璃提纯法以及快冷铸造法的大块金属玻璃和纳米结构合金的制备；电磁波屏蔽涂料的制备技术；
- 透射电子显微镜（包括 CTEM, HRTEM, HAADF in STEM mode, EELS，EDS），扫描电子显微镜（SEM），光学显微镜（OM），X-射线衍射（XRD），示差扫描量热仪（DSC），放点等离子烧结装置（SPS），等仪器的熟练操作和数据分析；
- 十分精通双喷电解抛光和离子减薄熟练制备合金（金属玻璃与纳米合金）的透射电子显微样品；
- 材料力学性能原理和测试技术；
- 熟悉热处理原理以及工艺设计，可以根据需求搭建合适的热处理设备以及设计恰当的参数；
- 熟悉金属塑性变形的有限元分析方法（ANSYS）；
- 了解分子动力学模拟的原理和方法。

11.研究兴趣

- 金属玻璃和纳米结构合金温度以及应力诱发相变动力学研究；
- 具有独特物理和力学性能的大块非晶合金以及纳米结构合金的制备合成；
- 具有独特微观结构的金属玻璃以及纳米结构合金的塑性变形机制；
- 亚稳玻璃形成液体在相变过程中的结构转变；
- 先进检测技术如原位中子和同步辐射散射、透射电子显微检测在复杂材料研究中的应用;
- 能源材料相变过程结构演变的原位研究；
- 先进聚合物基复合材料的工程应用。

Si LAN

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Research Interests: BMGs; Nanoglasses; Energy Materials; Neutron and Synchrotron Scattering; In-situ TEM.

1. Present Academic Position

Assistant Professor (Oct 2014-now) Herbert Gleiter Institute, Nanjing University of Science and Technology

2. Working Experience

Associate Professor, Deputy Director of Center of Neutron Science and Technology (Part-time), (Mar 2014-Now) City University of Hong Kong Shenzhen Research Institute

Postdoctoral Research Fellow (Nov 2012-Oct 2014), Department of Physics and Materials Science, City University of Hong Kong, Supervisor: Prof. WANG Xun-Li, The Best Proposal Award, 2013 International School on Neutron Scattering, Oxford University and ISIS.

3. Academic Experience

Period	Academic Experience
Aug 2009 - Oct 2012	PhD in Materials Science and Engineering, Department of Physics, The Chinese University of Hong Kong. Cumulative GPA: 3.955/ 4.0 C N Yang Scholarship (3 out of 112 research students in CUHK received this scholarship in 2012.)
Sep 2007 - Jun 2009	MS in Materials Processing Engineering, Department of Materials Engineering, Wuhan University. GPA: 3.90/ 4.00 Excellent communist party member award in Wuhan University
Sep 2003 - Jun 2007	BS in Materials Science and Engineering, Chengdu University of Technology. Chair of Student Committee. Major GPA: 3.94/ 4.0 Rank 1st out of 160 Students Excellent undergraduate student in Sichuan province Excellent student leader in Sichuan province, Third medal Whole-person developed undergraduate student in Sichuan Third place of China 'Challenge Cup' Entrepreneurship.

4. Funds

National Science Foundation of China for Young Scientist (25 W, hold);
Foundation for Central Universities, International Cooperation with Hong Kong (20 W, hold);
National Science Foundation of China (two different funding, ~350 W total, key member)
National Key Foundation, Ministry of Science and Technology of China (Neutron Scattering Extreme Environments, ~3300 W total, key member)

5. Service for community and honors

Jiangsu Province 'Double-Creative' Scheme;
Co-chair, Gordon Research Seminars on Neutron Scattering, 2016-2017;
MRS, TMS, HKPS members; Intermetallic, Journal of Materials Science Reviewer;

6. Publications

Published

(1) **Lan S**, Blodgett M, Kelton K F, et al. Structural crossover in a supercooled metallic liquid and the link to a liquid-to-liquid phase transition[J]. Applied Physics Letters, 2016, 108(21): 211907.

(2) **Lan S**, Wei X, Zhou J, et al. In-situ study of crystallization kinetics in ternary bulk metallic glass alloys with different glass forming abilities[J]. Applied Physics Letters, 2014, 105(20): 201906.

(3) **Lan S**, Yip Y L, Lau M T, et al. Direct imaging of phase separation in Pd 41.25 Ni 41.25 P 17.5 bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2012, 358(10): 1298-1302.

(4) **Lan S**, Lau M T, Kui H W. The time constant of the spinodal decomposition in Pd 41.25 Ni 41.25 P 17.5 bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2013, 361: 1-8.

(5) **Lan S**, Wu Z D, Lau M T, et al. Crystallization in homogeneous and phase-separated Pd 41.25 Ni 41.25 P 17.5 bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2013, 373: 5-12.

(6) **Lan S**, Blodgett M, Kelton K F, et al. Liquid-to-liquid phase transition underlying the structural crossover in a supercooled metallic liquid[J]. arXiv preprint arXiv:1509.03394, 2015.

(7) Jiao W, Wang X L, **Lan S**, et al. Propensity of bond exchange as a window into the mechanical properties of metallic glasses[J]. Applied Physics Letters, 2015, 106(6): 061910.

(8) Lau M T, **Lan S**, Yip Y L, et al. A metastable liquid state miscibility gap in undercooled Pd – Ni – P melts[J]. Journal of Non-Crystalline Solids, 2012, 358(18): 2667-2673.

(9) Huang Y, Kin W K, **Lan S**, et al. Observation of distinct atomic relaxation process in a phase-separated metallic glass-forming melt[J]. EPL (Europhysics Letters), 2014, 108(4): 46001.

(10) Wu Z D, Zhou W Z, Lo Y F, et al. On the short-range orders in spinodal Pd–Ni–P bulk metallic glasses[J]. Journal of Non-Crystalline Solids, 2015, 410: 51-57.

(11) Wu Z D, **Lan S**, Kui H W. Crystallization of Phase-Separated Pd41. 25Ni41. 25P17. 5 BMGs[J]. Metallurgical and Materials Transactions A, 2014, 45(5): 2399-2404.

(12) Pramanick A, Jørgensen M R V, Diallo S O, Christianson A D, Fernandez‐Baca J A, Hoffmann C, Wang X, **Lan S**, Wang X-L. Ferroelectric Materials: Nanoscale Atomic Displacements Ordering for Enhanced Piezoelectric Properties in Lead‐Free ABO3 Ferroelectrics (Adv. Mater. 29/2015)[J]. Advanced Materials, 2015, 27(29): 4329-4329.

(13) Wu Z D, **Si Lan**, Hin Wing Kui, Crystallization of phase separated BMGs, **TMS2013 Supplemental Proceedings**, Part III: Bulk Metallic Glasses X, 2013, 266: 259-266.

(14) Xiao W K, Han C C, **Lan S,** Ruan X F. Effect of electrical pulse on dynamic crystallization of ferrite and properties High-Carbon Chromium steel, The 2nd International Conference on Mechanic Automation and Control Engineering **(MACE 2011) Proceeding**, July, 2011.

(15) Fan T T, Xiao W K, Li L, **Lan S**, Li X T, "Research of Cr1-xMxN's (M=Al,V,Ti,etc.,x=0.5) Coating Valence Electron Structure Calculation and Wear-Resisting Performance", Advanced Materials Research, 2013, 706-708: 238-243.

(16) JIA Xi-guang, CHEN Shan-hua, TAO Qiao, **LAN Si**, YANG Xi. Preparation and Corrosion Resistance of CeO_2 Film on Magnesium Alloy, Materials protection, China, 4, 2009.（Chinese database）

(17) **Lan Si**, Zhang Zhouquan, Guan Denggao. Model Building and Property Investigation of Single Layer Nickel Based Electromagnetic Shielding Composite Materials in Wide Frequency., China Sci. and Tech. Rev., 24, 2008. （Chinese database）

In submission and under review

(1) **Si Lan,** Xun-li Wang**,** et al., liquid-to-liquid phase transition in a supercooled glass-forming metallic liquid, Nature Communications, Under review, 2016.

(2) **Si Lan,** Xun-Li Wang, et al., In-situ studies of transition of classic to avalanche nucleation in Zr-Cu-Al bulk metallic glasses and the correlation with glass-forming ability, Submitted to Acta Materialia, 2016.

(3) Xuelian Wu, **Si Lan,** et al., Probing atomic-to-nanoscale structures of Zr-based binary

metallic glasses and the correlation with glass-forming ability, Journal of Alloys and Compounds, Under review, 2016.

(4) M Naeem, **Si Lan** et al., Suppression of crystallization in Ca-based bulk metallic glass under compression, Submitted to Scripta Materialia, 2016.

7. Conference and invited talks

(1) **Si Lan, Xiaoya Wei,** Jie Zhou, Zhaoping Lu, Jörg Neuefeind, Tao Feng, Xun-Li Wang, In-situ neutron scattering study of phase stability in BMGs and nanoglasses, Oral presentation, BMG XI, St. Louis, USA, 2016.（Oral）

(2) M Naeem, **Si Lan** et al., Suppression of crystallization in Ca-based bulk metallic glass under compression. Hong Kong Physics Society annual meeting, Hong Kong, 2016 July. (Oral)

(3) **Si Lan, Xiaoya Wei,** Jie Zhou, Zhaoping Lu, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of transition of crystallization pathways in ternary bulk metallic glasses, Oral presentation, America Materials Research Society (MRS) 2015 fall meeting, Boston, MA, USA, 2015. （Oral）

(4) **Si Lan**, et al. Liquid-to-liquid phase transition underlying the structural crossover in a supercooled metallic liquid, Gordon Research Conference on Neutron Scattering, Presentation, Hong Kong, 2015. (Poster)

(5) Si Lan, Xiaoya Wei, Jie Zhou, Zhaoping Lu, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of transition of crystallization pathways in ternary bulk metallic glasses, Oral presentation, **Asia-Oceania Neutron Scattering Associatio**n 2015 annual meeting, Sydney, Australia, 2015 July. （Oral）

(6) Si Lan，Xunli Wang，et al.，In-situ structure studies of liquids and soft-magnetic amorphous alloys, NSFC committee and Amorphous Alloys Alliance Liquid Structure Seminars，Hefei Industrial University，Hefei，2015.（Oral）

(7) Si Lan，Xunli Wang，et al.，The Applications of In-situ SANS in BMGs，CSNS SANS Instrument Senior User Meeting，CSNS，Guangdong Dongguan，2015. (oral)

(8) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering study of crystallization kinetics in ternary bulk metallic glasses, Invited oral presentation, TMS 2014 annual meeting & exhibition, San Diego, USA, 2014.（Oral）

(9) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ study of crystallization kinetics and its correlation to glass-forming ability for ternary bulk metallic glasses, Oral presentation, BMG X, Shang Hai, China, 2014.（Oral）

(10) **Si Lan,** Yeuk Lan Yip, Man Tat Lau, Hin Wing Kui, Amorphous phase separation in a bulk metallic glass with negative heating of mixing, Oral presentation, TMS 2012 Annual meeting & exhibition, Orlando, FL, USA. （Oral）

(11) **Si Lan,** Amorphous phase separation in a bulk metallic glass of negative heat of mixing, invited oral presentation, City University of Hong Kong, Hong Kong, 2013. （Oral）

(12) **Si Lan,** Jie Zhou, Zhaoping Lu, Xun-Li Wang, In-situ neutron scattering study of crystallization kinetics in ternary bulk metallic glasses, Oral presentation, Hong Kong Physics Society 2013 annual meeting, Chinese University of Hong Kong, Hong Kong, 2013. （Oral）

(13) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of crystallization kinetics in ternary bulk metallic glasses, Oral presentation, America Materials Research Society (MRS) 2013 fall meeting, Boston, MA, USA, 2013. （Oral）

(14) **Si Lan,** Jie Zhou, Zhaoping Lu, Mikhail Feygenson, Jörg Neuefeind, Xun-Li Wang, In-situ neutron scattering and TEM study of crystallization kinetics in ternary bulk metallic glasse, The 1st CSNS Annual User Meeing，Guangdong Dongguan，Dec 2013 （Oral）

(15) Man Tat Lau, **Si Lan,** Yeuk Lan Yip, Hin Wing Kui, Determination of Phase Separation in Amorphous $Pd_{(40+0.5x)}Ni_{(40+0.5x)}P_{(20-x)}$ BMG for x = 0 to 4, Co-author, TMS 2012 Annual meeting & exhibition, Orlando, FL, USA.（Oral）

(16) Zhen Duo Wu, **Si Lan,** Hin Wing Kui, Crystallization of phase separated $Pd_{41.25}Ni_{41.25}P_{17.5}$ BMGs, Co-author, TMS 2013 Annual meeting & exhibition, San Antonio, TX, USA. （Oral, Co-author）

8. Research visiting and oversea study experience

- 2016 July, Research visited Sector 1-ID-E at **Advanced Photon Source (APS)**, Argonne National Laboratory (ANL), USA, for high temperature deformation study using in-situ WAXS/SAXS;
- 2015 November, Research visited Sector 1-ID-E at **Advanced Photon Source (APS)**, Argonne National Laboratory (ANL), USA, for liquid structure study with synchrotron x-ray Beamline using in-situ WAXS/SAXS;
- 2015 September, Visited Hokkaido University Microscopy Centers for in-situ study of liquid structure using high tension TEM and Cs corrected HRTEM;
- 2015 August, Visited 11-ID-C at **Advanced Photon Source (APS)**, Argonne National Laboratory (ANL), USA, for high temperature deformation study in Ca-based BMGs using in-situ PDF;
- 2015 July, Visited ANSTO Quokka beamline for simultaneous DSC-SANS study of crystallization and liquid transition in BMGs;
- 2014 November, Visited J-PARC NOVA beamline for study of dynamics of BMGs

(Phonons) using in-elastic neutron scattering;

- 2014 May, Research visited NOMAD diffratometer at **Spallation Neutron Source (SNS)**, Oak Ridge National Laboratory (ORNL), USA, for in-situ neutron scattering study of crystallization kinetics
- 2014 March, Research visited Sector 11-ID-C at **Advanced Photon Source (APS)**, Argonne National Laboratory (ANL), USA, for liquid structure study with synchrotron x-ray Beamline using in-situ PDF;
- 2013 November, Research visited **Washington University in St. Louis**, USA, for data collection and analysis of collaborated Beamline Electrostatic Levitation experiments.
- 2013 September, Studied in 13th **Oxford School on Neutron Scattering**, held by ISIS Spallation Neutron Source and Oxford University, and won **Best Proposal Award**.
- 2013 July, Research visited Sector 11-ID-C at **Advanced Photon Source**, Argonne National Laboratory, USA, for in-situ synchrotron scattering study of crystallization kinetics
- 2013 June, Research visited Sector 6-ID-D at **Advanced Photon Source (APS)**, Argonne National Laboratory (ANL), USA, for liquid structure study with synchrotron x-ray Beamline Electrostatic Levitation
- 2013 May, Research visited NOMAD diffratometer at **Spallation Neutron Source (SNS)**, Oak Ridge National Laboratory (ORNL), USA, for in-situ neutron scattering study of crystallization kinetics
- 2013 April, Research visited State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing, for preparing ternary Zr-based bulk metallic glasses
- Beam time proposals have been awarded frequently in SNS, ANSTO, J-PARC, APS etc..

9. Main Research and Professional Experience

9.1 Neutron and synchrotron scattering study of structural evolution in complex materials (Nov 2012-now, Form postdoc research until now)

We deployed in-situ neutron/synchrotron scattering and in-situ transmission electron microscopy (TEM) to study the structure evolution in BMGs while phase transitions take place. Structure evidence for phase transitions in selected BMG systems has been obtained by using excellent neutron and synchrotron sources in the world (SNS, ISIS, J-PARC, APS, Spring8, KENS etc.).

- **In-situ neutron and synchrotron scattering study of crystallization kinetics in ternary bulk metallic glasses**

To determine the nature of glass-forming ability (GFA), it is desirable to investigate the crystallization kinetics. However, complex chemistry in multicomponent alloys hinders the process to study the physics of crystallization, so it is necessary to simplify the chemistry. In this project, crystallization kinetics in two ternary BMGs, $Zr_{56}Cu_{36}Al_8$ and $Zr_{46}Cu_{46}Al_8$ with different GFAs, was studied using time-resolved neutron and synchrotron diffraction and in-situ TEM. The results revealed two different crystallization pathways and suggest that the development of medium and long-range ordering for $Zr_{46}Cu_{46}Al_8$ with better GFA may be more difficult than that for $Zr_{56}Cu_{36}Al_8$ with poorer GFA. Research papers are published in international journals (Appl. Phys. Lett., Acta Mater. etc.).

- **Probing structural evolution for liquid phase transitions in glass-forming metallic liquids: a Beamline Electrostatic Levitation study**

Physics in metallic liquids has attracted increasing attention because of its connection with the structure stability and glass-forming ability of bulk metallic glasses (BMGs). However, the occurrence of intervening crystallization limits the physics studies in the important temperature regime of undercooled metastable glass-forming metallic liquids. This results in a fact that important physics for metastable supercooled liquids are missing. To probe the structural evolution for metallic liquids during heating and cooling, easy glass-forming metallic liquids were chosen for study and Electrostatic Levitation equipped at sector 6-ID-D in APS, USA is employed. Structure evidence of a liquid phase transition has been identified for a liquid VIT106 alloy. Related papers have been preparing for submission to Physical review letters etc.. Another experimental proposal was also approved at sector 11-ID-C in APS, USA for 2014 A operation cycle. Several high-profile papers has be published in international journals.

9.3 Neutron and synchrotron scattering study for phase stability and plasticity interfaces in nanoglasses (Nov 2014-now, NJUST research)

- **Synchrotron scattering study of Ni-P nanoglasses with ultra-thermal-stablity**
- **Simultaneous WAXS/SAXS and in-situ TEM studies of plasticity of Ni-P nanoglasses**

9.3 Amorphous phase separation in a bulk metallic glass of negative heat of mixing (Aug 2009-Oct 2012, PHD research)

- **Direct imaging of phase separation in $Pd_{41.25}Ni_{41.25}P_{17.5}$ bulk metallic glasses**

  The alloy system, $Pd_{41.25}Ni_{41.25}P_{17.5}$, has a negative heat of mixing among its constituent elements. By using high resolution transmission electron microscopy, high angle annular dark field in scanning transmission mode, and energy dispersive x-ray spectroscopy, it was found that phase separation occurs in $Pd_{41.25}Ni_{41.25}P_{17.5}$ glassy alloys. For a clear exhibition of the amorphous phase separation reaction, it is desirable to introduce intermediate thermal annealing before an undercooled $Pd_{41.25}Ni_{41.25}P_{17.5}$ melt is cooled down to become a solid amorphous specimen. The results suggest that there may be unique short range orders in amorphous/liquid $Pd_{41.25}Ni_{41.25}P_{17.5}$, which are responsible for the phase separation. The research work has been published in Journal of Non-Crystalline solids.

- **A metastable liquid state miscibility gap in undercooled Pd-Ni-P melts**

  In this work, BMG of compositions, $Pd_{40+0.5x}Ni_{40+0.5x}P_{20-x}$ with x = 0 to 3.5, were studied for amorphous phase separation. It occurs for $x \gtrsim 1$, but absent for $x \lesssim 1$. In addition, in phase-separated specimens, the characteristic size or wavelength of the decomposed phases was measured. It was found that they obey the lever rule. The experimental results suggest the existence of a metastable liquid/amorphous miscibility gap. Its origin is attributed to unique short range orders in the undercooled Pd-Ni-P melts. This work has been published in Journal of Non-Crystalline solids.

- **The time constant of the spinodal decomposition in $Pd_{41.25}Ni_{41.25}P_{17.5}$ bulk metallic glasses**
  Experimental arrangements were made to study the spinodal reaction occurring in undercooled molten $Pd_{41.75}Ni_{41.75}P_{17.5}$ alloys as a function of time. The lower bound of the duration of the spinodal decomposition a temperature of ≈625 K is about 200 s and the time constant R of the spinodal decomposition at a temperature of 625 K is 0.002 s^{-1}. This paper has been published in Journal of Non-Crystalline solids.

- **Crystallization of amorphous $Pd_{41.25}Ni_{41.25}P_{17.5}$: Homogeneous and phase-separated bulk metallic glasses**
  $Pd_{41.25}Ni_{41.25}P_{17.5}$ BMG can be prepared in three different microstructures: a homogeneous glass (A-type), a homogeneous glass with crystalline precipitates (B-type), and a phase-separated glass (C-type). They were thermally annealed at different temperatures for partial crystallization. The crystallization behaviors of these different types of specimens has been characterized by TEM and DSC etc.. A paper has been published in Journal of Non-Crystalline solids.

- **Synthesis of Zr-based、Ti-based and Fe-based BMGs and nanostructured alloys by arc-melting or fluxing**

9.4 Plastic deformation mechanism of high-carbon chromium steels with electrical pulse heat treatment (Sep 2007-Jun 2009, MS research)

- In this project, a novel method of plastic deformation of hard deformed steels with electrical pulse heating was developed. The **dynamic recovery and recrystallization kinetics** behaviors on the plastic deformation with electrical pulse heating were observed by CTEM characterization. ANSYS finite element analysis of plastic deformation of steels with and without electro-pulsing heating was performed. I have systematically studied the **dislocations theory** in this period of research work time.

9.5 Preparation of Ni-based thin layers electro-magnetic waves shielding coating materials in a wide frequency range. (Sep 2006-Jun 2007)

7. Experimental Skills

- High familiarization with the theory and experimental methods for neutron and synchrotron x-ray scattering;
- High familiarization with the data analysis methods (Fit2d, PDFgetX2, PDFgetX3, batch processing software of WU-BESL, GSAS, DAVE etc.) for neutron and synchrotron x-ray scattering;
- Preparation of bulk metallic glasses, undercooled nano-structured alloys by fluxing techniques and as-cast methods (RF induction melting, Arc melting)
- Skillful operations and data analysis of CTEM, HRTEM, HAADF in STEM mode, EDX, EELS, OM, SEM, XRD, DSC, SPS, etc.
- High familiarization with TEM sample preparation of alloys (including BMGs) by Twin Jet Electro-polishing and Ion Miller Polishing methods

- Mechanical properties experiments in room temperature and high temperature
- Heat-treatment principles and processes designing
- The basic ANSYS finite element analysis of plastic deformation of metals
- The theory and method of MD simulation

8. Research Interests

- Microstructural kinetics of phase transformation in metals and alloys induced by temperature and pressure;
- Synthesis of BMGs and nanostructured alloys with unique physical and mechanical properties;
- Mechanisms of plasticity in bulk metallic glasses (BMGs) and nanostructured alloys with unique microstructure;
- structure evolution in metastable glass-forming metallic liquids during phase transitions;
- The application of advanced characterization techniques, such as in-situ neutron/synchrotron scattering and TEM, for complex materials study;
- In-situ study of phase transformations in energy storage materials.
- Engineering applications of advanced polymer-based composites.