Beamline Scientist Individual Annual Report (Nov. 2015 – Nov. 20156

**Name:** Jinyuan Yan

**Position:** Project Scientist

**Length of time at current position**: Since Feb. 2006

**Brief job description**: Provide user support, instrumentation development/improvement at beamline 12.2.2 , ALS;

**Activities**

**General description of your activities** : In the last year, I have conducted some scientific research projects, collaborated with my collaborators with their scientific projects, supported users, instrumentation development/improvement to enhance "user friendliness", which includes: (1). Designed and built 270 degree side “Double-sided laser heating radial diffraction system” for radial x-ray diffraction work (2) Development of Tungsten resistive heater for modified BX90 and temperature reached up to 1400C , (3) Thermal conductivity measurement technique development, (4) provide boron-kypton gaskets for COMPRES community users etc. (5). Support users.

**Scientific projects involved :**

(1). Designed and built 270 degree side of “Double-sided laser heating radial diffraction system” The previous radial double-sided laser heating system has been designed and manufactured. Due to its long arm of 270 side, the laser heated hotspot get defocued while heating. I re-designed and built different 270 side of the double-sided laser heating radial diffraction system, and solved the defocused issue. Now the whole double-sided laser heating radial diffraction system work very well, and an instrumention paper is underway.

(2). “Development of user-friendly resistive heater for modified BX90 DAC above 1000C”. The existing resistive heater in the COMPRES community either hard to assembly/mount but with higher temerpature (like internal heater), or easy assembly but lower temperature (like external heater. In this project I developed  a novel tungsten external heater for the modified BX90 cell, and the temperature has achieved up to 1416C with reducing gas. The thermal expansion of MgO result shows that the compression pressure was released up to 600C. Next step is either select high temeprature material for cell or re-design the cell holder to hold the compression pressure. This heater is designed to be a modular, plug-and-play design and is hence quite user friendly.  It covers both the low temperature range, and also overlaps the higher temperature range that is achievable by laser heating.

(3) “Thermal conductivity measurement technique development”. 2-D radial temperature map technique has been setup at beamline 12.2.2. to measure radial temperature distributions of laser-heated samples in the Diamond Anvil Cell. Rainey, E. S. G., and A. Kavner has developed an thermal conductivity technique by combining with numerical models. This project is to explore this technique and apply it to beamline 12.2.2.

(4). “Foil heater development” A specific designed foil heater has been manufactured for Bin Chen, University of Hawai'i at Manoa, for resistive heating technique.

(5). Provide boron-kypton gaskets for COMPRES community users.

**Publications.**

1. Chen, Y., S. Zhang, W. . Gao, F. Ke, J. Yan, B. Saha, C. Ko, B. Chen, J.W. Ager III, W. Walukiewicz, R. Jeanloz, and J. Wu, "Pressure-induced structural transition of CdxZn1−xO alloys," Applied Physics Letters 108(15), 152105 (2016). (doi:10.1063/1.4947022) 12.2.2

2.Liu, Gang, Lingping Kong, Jinyuan Yan, Zhenxian Liu, Hengzhon Zhang, P. Lei, T. Xu, Ho-kwang Mao, and B. Chen, "Nanocrystals in compression: unexpected structural phase transition and amorphization due to surface impurities," Nanoscale 8(23), 11803-11809 (2016). (doi:10.1039/C5NR09027J) 12.2.2

3. Raju, S.V., B.K. Godwal, J. Yan, R. Jeanloz, and S.K. Saxena, "Yield strength of Ni–Al–Cr superalloy under pressure," Journal of Alloys and Compounds 657, 889-892 (2 2016). (doi:10.1016/j.jallcom.2015.10.092) 12.2.2

4. Yue, Binbin, Fang Hong, Sébastien Merkel, Dayong Tan, Jinyuan Yan, B. Chen, and Ho-Kwang Mao, "Deformation Behavior across the Zircon-Scheelite Phase Transition," Physical Review Letters 117(13), 135701 (2016). (doi:10.1103/PhysRevLett.117.135701) 12.2.2

**Papers submitted**

1. Dayong Tan, Xueting Liu, Yu Tian, Huifang Zhao, Yunhong He, Binbin Yue, Ho-Kwang Mao, Bin Chen, Jinyuan Yan, Wansheng Xiao, “Stability of pyrite-type platinum dioxide at pressure and temperature conditions of the Earth’s mantle” Submitted American Minerologist

2. Binbin Yue, Fang Hong, Zhenxiang Cheng, Shibo Li, Yanping Yang, Jinyuan Yan, Martin Kunz, Bin Chen, Ho-Kwang Mao “In situ investigation on the strength anisotropy and plastic deformation of Ti3AlC2 under high pressure”

3. Dylan R. Rittman, Katlyn M. Turner, Sulgiye Park, Antonio F. Fuentes, Jinyuan Yan, Wendy L. Mao, Rodney C. Ewing “Effect of radius ratio on the high-pressure structural response of A2B2O7 pyrochlores (A = Eu, Dy; B = Ti, Zr)” Submitted to

4. C. Nisr, Y. Meng, A. MacDowell, J. Yan, V. Prakapenka, and S.-H. Shim “Thermal Expansion of SiC at High Pressure–Temperature and Implications for Thermal Convection in the Deep Interiors of Carbide Exoplanets” submitted to Journal of Geophysical Research

**Papers in preparation**

1. “A tungsten ring heater up to 1700K for diamond anvil cell high temperature and high pressure applications”

2.“The current status of the double side laser heating system at beamline 1222, Advanced Light Source”

**Users supported**

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| **Bin Chen** | **Hawaii University** | **Jan 28-31 2016** |
| **Sui-wai Chan** | **Columbia University** | **Feb 19-22** |

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| **Quentin Williams** | **University California, Santa Cruz** | **Feb. 18-19** |

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| **Sarah Tobert** | **University California, Los Angeles** | **March 11-14** |

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| **Quentin Williams** | **University California, Santa Cruz** | **Apr 7-8** |

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| **Low Miyagi** | **The University of Utah** | **May 4-8** |

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| **Quentin Williams** | **University California, Santa Cruz** | **May 25-26** |

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| **Matthew McCLuskey** | **Washington State Uni.** | **May-21-22** |

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| **Low Miyagi** | **The University of Utah** | **June 18-19** |

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| **Weny Mao** | **Stanford University** | **June 24-27** |

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| **Sarah Tobert** | **University California, Los Angeles** | **July 1-3** |
| **Quentin Williams** | **University California, Santa Cruz** | **Sep 2-3** |
| **Matthew McCLuskey** | **Washington State Uni.** | **Sep 9-11** |
| **Quentin Williams** | **University California, Santa Cruz** | **Oct. 14-15** |
| **Qiaoshi Charles Zeng** | **HPStar, Shanghai, China** | **Oct. 26-29** |
| **Low Miyagi** | **The University of Utah** | **Nov. 3-6** |
| **Sang-Heon (Dan) Shim** | **Arizona State University** | **Nov. 9-11** |

**Instrumentation development/improvement participated**.

1.Development of “Double-sided laser heating radial diffraction system”

2. Development of user-friendly resistive heater above 1000C for DAC.

3. Thermal conductivity measurement technique development.

**Proposals participated in writing (either for other users, for yourself to the synchrotron facility, or to outside agencies).**

1. Jinyuan Yan “Resistive heating developments at BL 12.2.2 and its applications in axial and radial XRD experiments” to beamline 12.2.2.
2. Jinyuan Yan “Laser heating temperature accuracy investigation by Iron phase transition” to beamline 12.2.2.
3. Help Hengzhong Zhang (UCB) “Doping and growth of titania in high-temperature & pressure hydrothermal condition” to beamline 12.2.2.