Beamline Scientist Individual Annual Report (Nov. 2014 – Nov. 2015)

**Name:** Jinyuan Yan

**Position:** Project Scientist

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

**Brief job description**: Provide user support, instrumentation development/improvement, and software developmental work 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, and software development for the online and offline system to enhance "user friendliness", which includes: (1). Development of “Double-sided laser heating radial diffraction system” to for uniaxial radial x-ray diffraction work. (2). Characterization of the axial laser heating system by thermal expansion measurement, (3) Development of resistive heater for DAC above 1000C , (4) Thermal conductivity measurement technique development, (5) provide boron-kypton gaskets for COMPRES community users etc.

**Scientific projects involved :**

(1). Development of “Double-sided laser heating radial diffraction system” A unique radial double-sided laser heating system has been designed and manufactured, but due to unknow reason, the system are not working properly. In the last few monthes, diagosis and trouble-shotting of the system has been conducted, and the project is ongoing.

**(2). “**Characterization of the laser heating system by thermal expansion measurement of Ta,**”,** Previously double-layer laser heating system has been de-commisioned, and compact one single board system has been setup. In this project, in-situ laser heating of Ta powder angle-dispersive x-ray diffraction will be performed to justify the performance of quality of the axial laser heating system at beamline 12.2.

(3). “Development of user-friendly resistive heater for DAC above 1000C”. The previous resistive heater on beamline 12.2.2 has been implemented by combining a band resistive heater together with resistive wire heater to reach high temperature. The setup of the dual heater is more complicate, and the wire heater always breaks previouly. In this project, we plan to develop a robust, modular, and plug-play resistive heating technique so that we can push the regular heating temperature up to 1300K, which overlap with laser heating at beamline 12.2.2. This project is underway.

(4) “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. The plan of this project is to measure the pressure and temperature dependence of thermal conductivity of materials by combining with numerical models.

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

(5). “in-situ high-temperature high-pressure study of CaCO3 and iron’, in this ongoing project, HPT behavior of CaCO3 and iron will be investigated, with temperature up to 2500K and pressure up to 50 GPa.

(6). Provide boron-kypton gaskets for COMPRES community users, but not beamline 12.2.2 user, such as Xingguo Hong, Qiaoshi, Zeng, eta.

**Publications.**

**Raju, S.V., A.A. Oni, B.K. Godwal, J. Yan, V. Drozd, S. Srinivasan, J.M. Lebbeau, K. Rajan, and S.K. Saxena, "Effect of B and Cr on elastic strength and crystal structure of Ni3Al alloys under high pressure," Journal of Alloys and Compounds 619, 616-620 (January 2015). (doi:10.1016/j.jallcom.2014.09.012) 12.2.2**

**S.V. Raju,\*, B.K. Godwal, J. Yan, R. Jeanloz, S. K .Saxena, "Yield Strength of Ni-Al-Cr superalloy under pressure" accepted by** J. Alloys and Compounds

Jinyuan Yan, Alastair MacDowell, Yunian Lou, Edward E. Domning, Quentin Williams “A Labview-based Motor Controlled Offline Ruby System” In preparation for Measurement” LBL internal report

Papers in preparation

1. Jinyuan Yan,Alastair A. MacDowell, Martin Kunz, Bin Chen, Quentin Williams “Model simulation for laser heating temperature measurement and 2D temperature mapping ”, in preparation for RSI
2. Jinyuan Yan, Bora Kalkan, Alastair MacDowell, Edward Domning, Yunian Lou, Quentin Williams “Automated LABVIEW-based data reduction program for amorphous x-ray diffraction”
3. Alastair A. MacDowell, Jinyuan Yan, Quentin Williams, Martin Kunz “Characterization of the laser heating system by thermal expansion measurement of Ta”, in preparation for RSI
4. Jinyuan Yan, Bin Chen, Alastair A. MacDowell, Quentin Williams “In situ high P-T laser heating x-ray diffraction study of Re up to 50 GPa”, in preparation for JAP

**Users supported**

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| **Budhiram Godwal** | **University California, Berkeley** | **Dec. 20-22, 2014** |
| **Shizhong Yang** | **Stanford University** | **Dec. 22-24** |
| **Budhiram Godwal** | **University California, Berkeley** | **Dec. 24-26** |
| **Sarah Tobert** | **University California, Los Angeles** | **Dec. 5-8** |
| **Bin Chen** | **HPSTAR, Shanghai, China** | **Dec. 9-11** |
| **Quentin Williams** | **University California, Santa Cruz** | **Dec. 19-22** |
| **Weny Mao** | **Stanford University** | **Jan. 23-25, 2015** |
| **Bin Chen** | **HPSTAR, Shanghai, China** | **Dec. 9-11** |
| **Budhiram Godwal** | **University California, Berkeley** | **Feb 19-23** |
| **Sarah Tobert** | **University California, Los Angeles** | **March 6-9** |
| **Wemdy Mao** | **Stanford University** | **Apr. 17-19** |
| **Quentin Williams** | **University California, Santa Cruz** | **Apr. 21-23** |
| **Bin Chen** | University of Hawai'i at Manoa | **May 24-25** |
| **Budhiram Godwal** | **University California, Berkeley** | **May 21~24** |
| **Quentin Williams** | **University California, Santa Cruz** | **June 05~06** |
| **Low Miyagi** | **The University of Utah** | **Aug. 21-25** |
| **Quentin Williams** | **University California, Santa Cruz** | **Sep. 3** |
| **Sui-wai Chan** | **Columbia University** | **Aug. 15-16** |
| **Sarah Tobert** | **University California, Los Angeles** | **Sep. 18-21** |
| **LLNL** | **LLNL** | **Sep. 26-27** |
| **Oliver Tschauner** | **UNLV** | **Oct. 8** |
| **LLNL** | **LLNL** | **Oct. 16-19** |
| **Wendy Mao** | **Stanford University** | **Oct. 21-Oct. 22** |
| **Rudy Wenk** | **UCB** | **Oct. 23-26** |

**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.

**Any progress with improving the "user friendliness" of data reduction software, and any new software you helped**

1. Developed “A Labview-based Motor Controlled Offline Ruby System”, which has been put into use .
2. Developed “Automated LABVIEW data reduction program for amorphous x-ray diffraction” , which is going to be tested, and paper in preparation.

**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.