US-China Winter School on New Functionalities in Glass

Hang Zhou, China

January 4-15, 2010

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Sponsored by

- Nationals Science Foundation's International Materials Institute for New Functionality in Glass (IMI-NFG)
- Graduate School of Zhejiang University
- Corning Inc.
- Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

An Int'l Materials Institute (IMI) - NSF's vision, shared by many countries

In response to globalization of humanity …

An IMI's long term goal is the **creation of a worldwide network in materials research and the development of a new generation of scientists and engineers with enhanced international leadership capabilities**. A critically important aspect of an IMI is its potential impact on **advancing materials research on an international scale and developing an internationally competitive generation of materials researchers**, and this distinguishes an IMI from other materials research centers that NSF supports.

An Assessment of Glass Research, Education, and Industry

Past performance

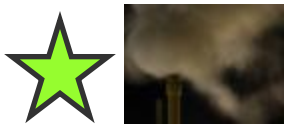
- **National Academy of Engineering (NAE): Half of the 20th century's 20 greatest engineering achievements made use of glass and a quarter of them with glass as a critical component.**

- **No other class of materials has contributed to so many modern day technologies as glass.**

NAE: Engg's Grand Challenges for 21st Century

Make solar energy economical

Provide energy from fusion



Develop carbon sequestration methods

Manage the nitrogen cycle

Provide access to clean water

Advance health informatics

Engineer better medicines

Reverse-engineer the brain

Prevent nuclear terror

Secure cyberspace

Restore and improve urban infrastructure

Enhance virtual reality

Advance personalized learning

Engineer the tools of scientific discovery

A successful resolution of ~11 out of 14 challenges would rely on glass either as a support material or as an active component for sensing, information storage, chemical delivery, etc.

Current Situation of Glass

During the last 2-3 decades worldwide:

- **Elimination of many industrial laboratories**
- **Shift of governmental funding to nano and biosciences.**
- **In academia, retirement of senior leaders at the traditional academic centers and a concurrent hiring of solo faculty at a much larger number of institutions.**

Int'l Materials Inst. for New Functionality in Glass

Established 2004

Mission

Focus, coordinate and promote educational and research activities across the globe to introduce new functionality in glass

Int'l Network - Advisory Boards:

- US
- International
- Industry

Education:

- Internet courses
- Video modules
- Int'l school
- Hands-on Demos

Research:

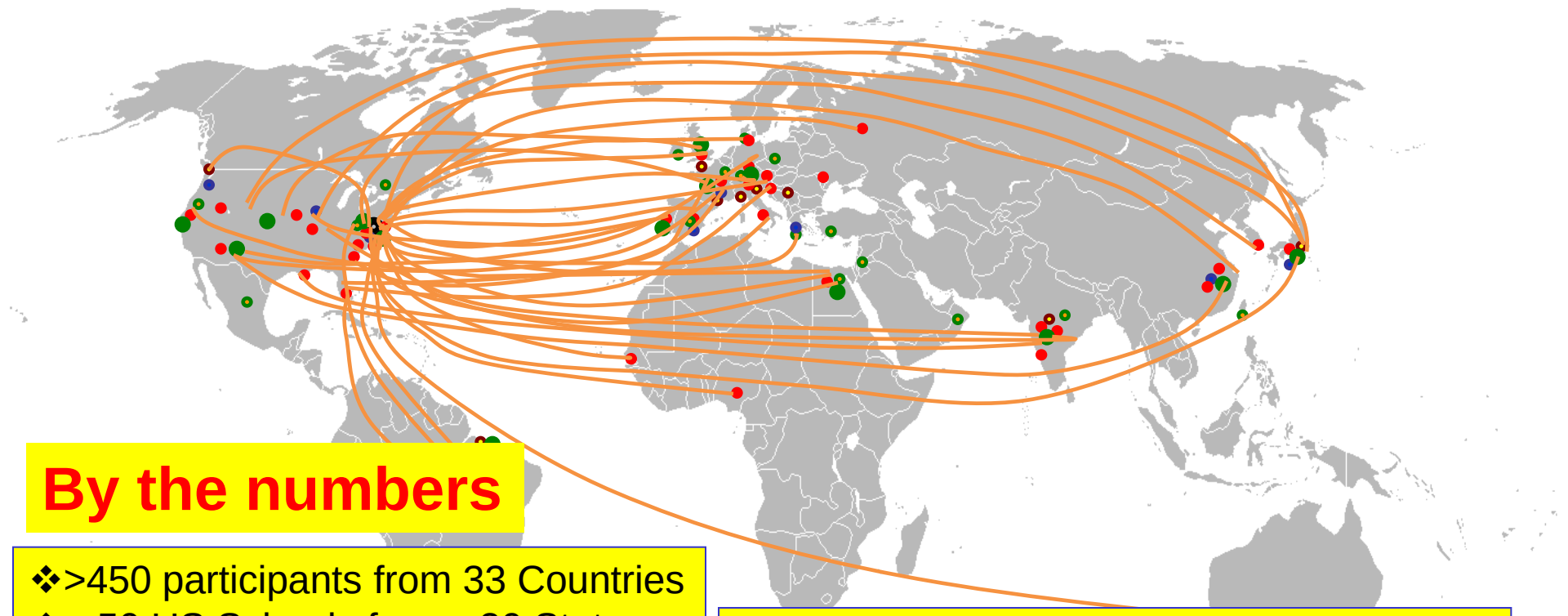
- Int'l exchanges
- Int'l Conf Travel Scholarship
- Faculty sabbatical

Functionality driven symposia & workshops:

- Key scientific issues

Growth of IMI-NFG Global Network

2004-2009



By the numbers

- ❖>450 participants from 33 Countries
- ❖ ~50 US Schools from ~30 States

Funded Int'l Exchanges:

- ❖ >80 Int'l Exchanges

Int'l Conf Travel Scholarships:

- ❖ 43 to 10 countries

- ❖ >150 peer reviewed publications
- ❖Several national and international awards

- Board of Advisers
- IMI-NFG Events - Participants
- Lehigh Univ. and Penn State Univ.

Australia	China	France	India	Italy	Oman	Romania	Slovakia	Switzerland	Ukraine
Brazil	Czech Rep.	Germany	Ireland	Japan	Poland	Russia	South Korea	Taiwan	U.K
Bulgaria	Denmark	Greece	Israel	Nigeria	Portugal	Senegal	Spain	Turkey	U.S.A
Canada	Egypt	Hungary							

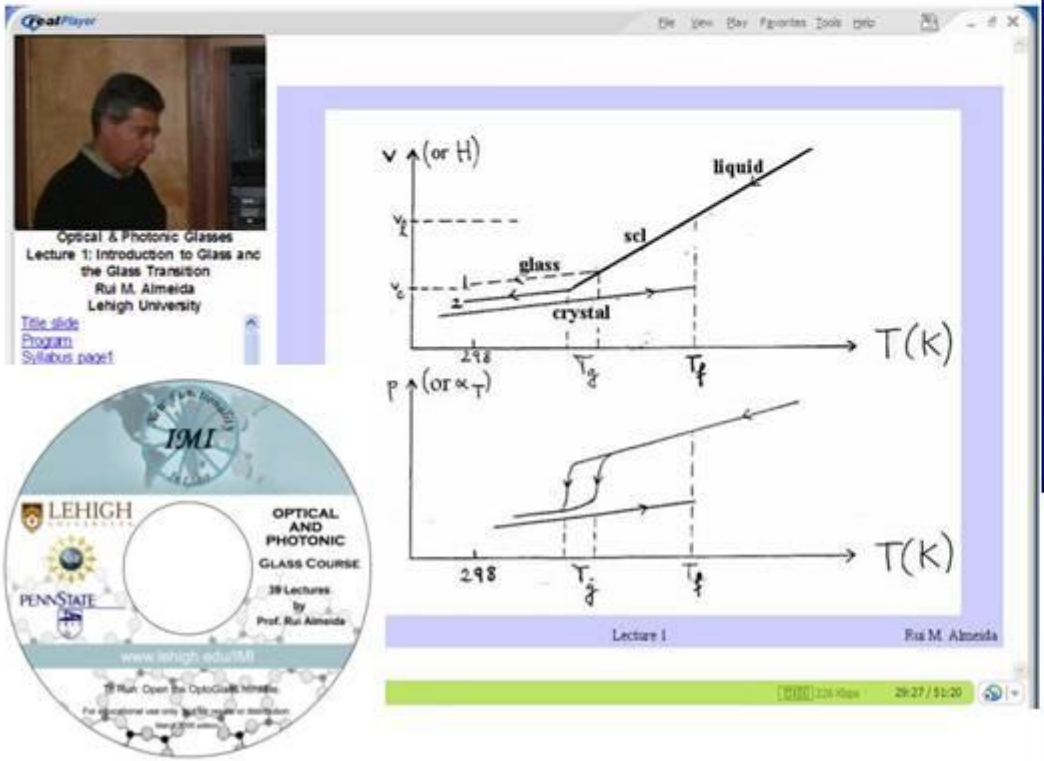
Int'l Research Exchanges

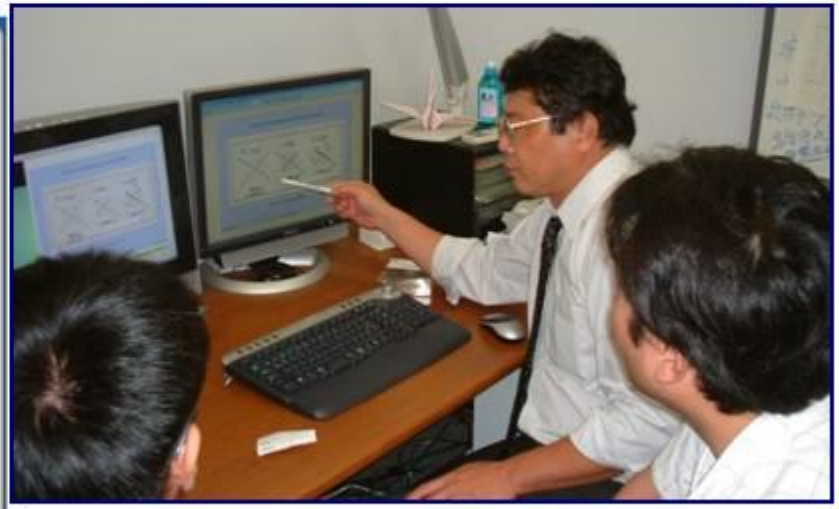
- Supports US↔abroad exchange of graduate students, post-docs and faculty engaged in glass research anywhere, preferably in one of the thrust areas.
- Duration 1 to 6 months, typically 3 months
- For US researchers both travel and living expenses are reimbursed
- For foreign visitors to the US, the living expenses in the US are covered. However, for researchers from certain developing countries some travel support may also be provided.

Goals of IMI-NFG: Education

Multimedia Glass Education delivered across the boundaries

- >180 of Internet topical video modules
- New semester courses by visitors on sabbatical
- Multiple instructor team teaching (MITT)





Associate Professor K. Miura at Kyoto University uses one of the 39 lectures from the Optical & Photonic Glass Course by Professor Rui Almeida (Portugal) to explain IR vibrational modes to two graduate students. This course by IMI-NFG is available on DVD or streaming video free of charge.

Multi-Institutional Team Teaching (MITT)

- **The Problem:**
- Graduate education is growing more and more specialized
  - Graduate courses reflect the increasingly specialized nature of graduate research
  - Especially so in science and technology fields
- Universities, however, are requiring more efficiency - "teach fewer courses to larger numbers of students

  …..*with higher quality*"
  - ~ 10 students is a typical minimum course enrollment for offering
- ***How do we offer the highly specialized graduate courses our research and graduate education programs require, but do so in a manner that increases efficiency, but yet maintains or increases quality?***

Relaxation Processes in Glasses and Polymers

A New MITT Glass Course for Spring 2010 Semester

http://www.lehigh.edu/imi/GlassRelaxationCourse.htm

Instructors:

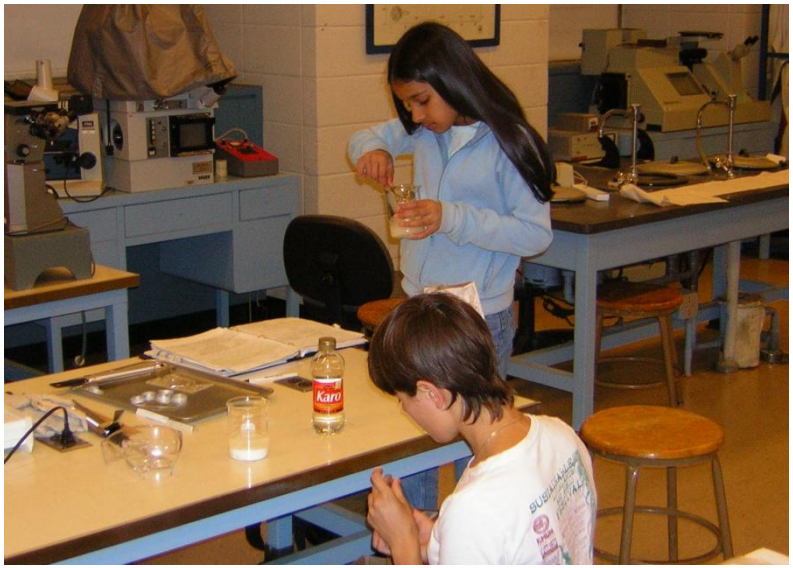
Prof. Reinhardt Conradt, RWTH Aachen, Germany
Prof. Chris Cox, Clemson University
Dr. Ulrich Fotheringham, Adj. Prof., Schott AG, Germany
Prof. Dr. Prabhat Gupta, Ohio State University
Prof. Roger Loucks, Alfred University
Prof. Steve Martin, Iowa State University

Time for live lecture:
Tuesday and Thursday. 3 pm EST-USA (9 pm German time)

Start Date: January 19th (Course orientation)
First full lecture: January 21

Outreach to the K-12 community: Developing resources to share the excitement of glass!

IMI-NFG is using familiar materials and hands-on experiments to demonstrate the basic concepts of materials science and technology.



Clockwise from left above: Pre-college students assist in the design of experiments and lab demonstration modules on glass science. Undergraduate students share the excitement of glass blowing and adventures of glass research with visitors to the open house at Penn State.

Emerging activities: Partnership with NSLS-II

NSLS-II will produce x-rays up to 10,000 times brighter than today!

Well Established Techniques

1. Standard/Quick EXAFS
2. Pump-probe EXAFS
3. Total X-ray scattering
4. XPS
5. NEXAFS, XANES
6. Small angle X-ray scattering for nanoscale heterogeneity
7. Micro-diffraction
8. Anomalous x-ray scattering

Advanced Techniques

9. High Energy XRD at High T and P
10. Combined X-ray techniques like SAXS/WAXS; Optical (i.e. luminescence) EXAFS.
11. Synchrotron X-ray microprobe tomography
12. X-ray Raman Spectroscopy
13. Synchrotron Mossbauer spectroscopy

Enjoy the next couple of weeks!

Note:

Most important plans and decisions are made in hallways or over the beer…

Friendship and new ideas nucleate spontaneously when the environment is right, and it is right now!

IMI-NFG resources are here for you…

Please visit:
www.lehigh.edu/imi

Message from Sarah:

Check Winter School web site for update on assignments.