Building on Partnerships and Networks: Introduction to Joint Funding Opportunities

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And

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The Origins of The US/Africa Materials Network and USAMI

- The visionary behind the Materials World Network is Adriaan de Graaf of the National Science Foundation
- Adriaan saw the potential of the African Materials Network and conceived of the idea of the International Materials Institutes
- The efforts to build the US/Africa materials network were also stimulated by Bill Clinton's visit to Africa as President – first by a US President in office
- Partly as a result of this visit the National Science Foundation organized a US/Africa materials workshop in Pretoria in 2000
- The ideas from this workshop have guided the development of the US/Africa Materials Institute (USAMI) which started in 2002
- USAMI is an interdisciplinary institute that coordinates the activities of US and African scientists in the areas of materials research and education

U.S. Institutions/Collaborators

• Ohio State University	Soboyejo
• Harvard University	Vlassak, Hutchinson
• Brown	Needleman
• Yale University	Ramirez
• Columbia	Kysar
• Duke	Warren
• Arizona State University	Alford
• University of Tennessee	Liaw
• LSU/CAMD	Hormes, Kumar
• UIUC	Paulino
• Rutgers University	Cuitino, Garfunkel
• Sandia	Buchheit, Boyce
• Pennington Biomedical	Leuschner

H. Jain (Lehigh),
C. Pantano (Penn State)
http://www.lehigh.edu/~inimif/home.htm

US / Africa Materials Institute

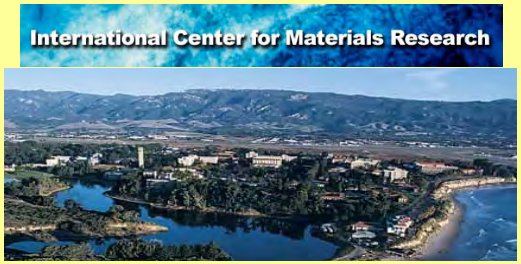
W. Soboyejo (Princeton)
http://usami.princeton.edu

K. Rajan (Iowa St)
Maryland, Florida Int.
http://cosmic.rpi.edu

IMIs
$600-700 K/yr each

I2CAM
International Institute for Complex Adaptive Matter

D. Cox (UC-Davis)
UC system, others …
http://www.i2cam.org



A. Cheetham (UCSB)
http://www.icmr.ucsb.edu

Advanced Neutron Scattering netWork for Education and Research
P. Liaw (UT-Knoxville)
ORNL, others.
http://answer.utk.edu

The Structure of USAMI

- A virtual institute operated from Princeton University
- Princeton setting includes
  - PRISM (Jim Sturm, Kim Hegelbach, Jeff Petsis, Dan Steinberg, Shannon Swilley)
  - Institute for Advanced Studies (Arlen Hastings, Lori Piranian & Phillip Griffiths)
  - Carl Fields Center/Third World Center (Makeba Clay)
- Administrative/technical staff members
  - Dale Grieb (Administrator)
  - Tina McCoy (Program Manager)
  - Mike Vocaturo (Technical Support)
  - David Radcliff (Web Support)

Advisory Groups

- Executive Committee (Internal)
  - Bob Prud'homme (CHE)
  - George Scherer (CEE)
  - Jeff Schwartz (CHM)
  - Rick Register (CHE)
- Advisory Council (External)
  - Philip Griffith (Institute for Advanced Studies)
  - Dianne Rekow (NYU)
  - Alan Needleman (Brown)
  - Eric Doehne (Getty)
  - Peter Green (Michigan)

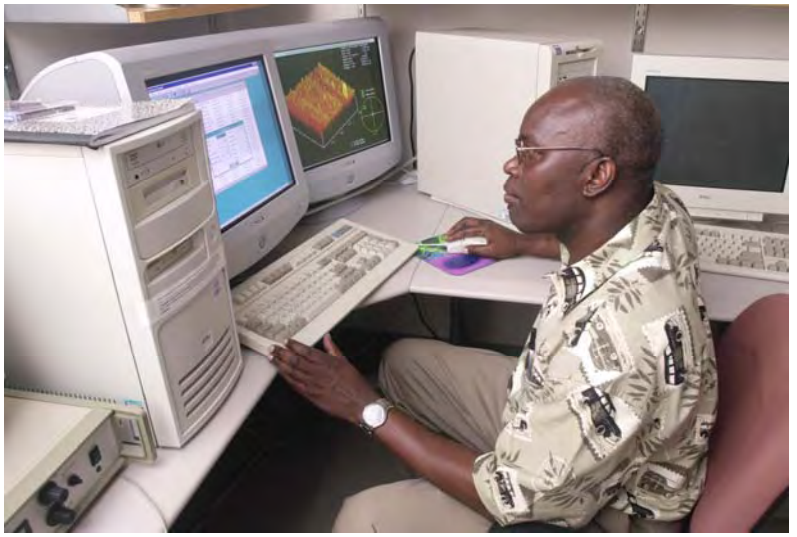
Princeton Scientists & Students

- Faculty – Scherer, Prud'homme, Schwartz, Ong, Register, Arnold, Young, Haataja, Gmachl, Ju
- Senior Scientists – Yao, Steinberg, Vocaturo
- Post-doc – Niu
- Graduate Students – Meng, Chen, Akogwu, Shan, Oni, Ismaiel, Theriault, Paetzell, Yu
- Undergraduate Students – Wachter, Ramcharam, Camille-Friedman, Usoro

African Countries and Collaborators

- The works with a group of about 100 collaborating African researchers with backgrounds in physics, chemistry, biology, materials science and engineering
- We have collaborators in 21 African countries
  - Eastern Africa – Kenya, Uganda, Ethiopia, Tanzania, Burundi
  - Northern Africa – Egypt, Tunisia, Algeria, Morocco
  - Western Africa – Senegal, Nigeria, Ghana, Burkina Faso
  - Central Africa – Rwanda, Cameroon
  - Southern Africa – South Africa, Zambia, Botswana, Mozambique, Namibia, Zimbabwe

Some USAMI Scientists at Work in The US

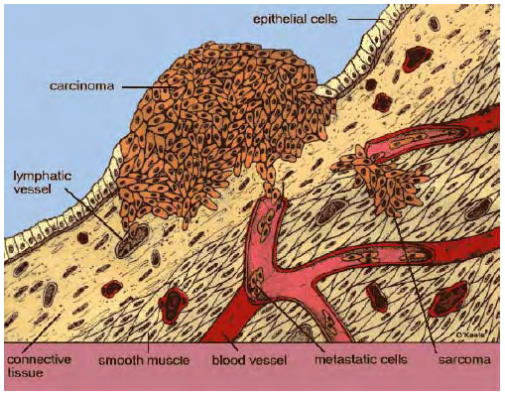


Approach of The USAMI Program

- 16 international researchers visit the U.S. to work with U.S. collaborators for 9 weeks
- They then return to their home countries to continue their work
- Many return over the next few years to do a complete piece of work
- A systems based approach - must work in one of the four areas of focus

Systems-Based Interdisciplinary Materials Research & Education in USAMI

- Advanced Materials (Bio and Nano)
  - Targeting of disease
  - Alternative energy
- Societal Development
  - Affordable infrastructure e.g. recycling of agricultural & industrial waste
  - Value addition to minerals and natural products (Africa's silicon)



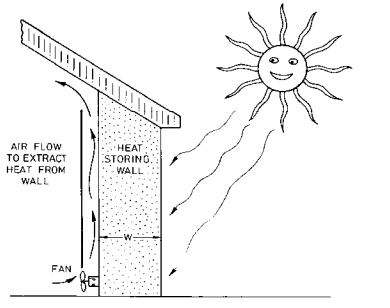
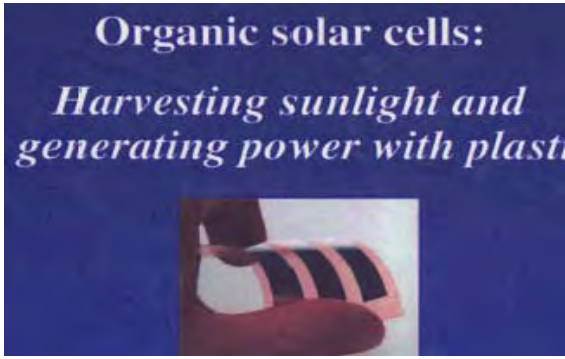


FIG. 6.32 A heat-storing wall. The sun shines on the outside during the day; heat is extracted from the inside at night. The heat diffusion time through the wall must be about 12 hours.



Porous Ceramics For Water Filtration

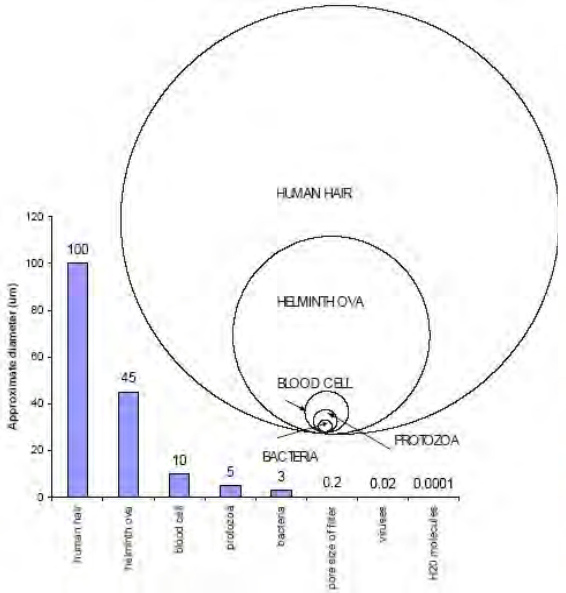
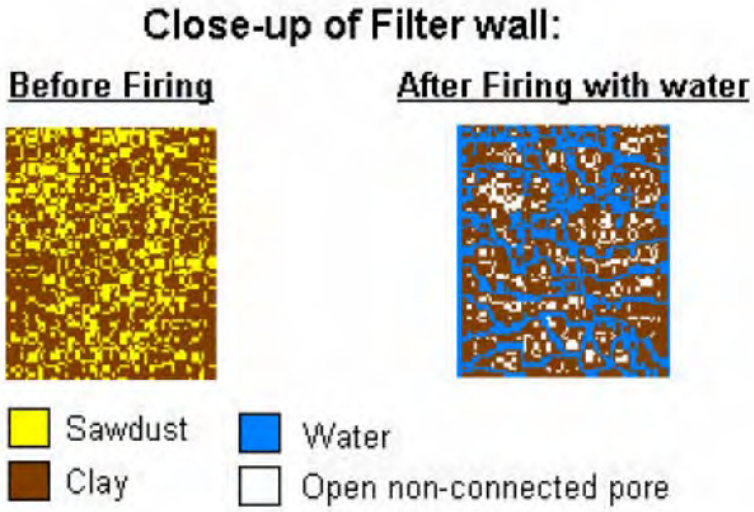
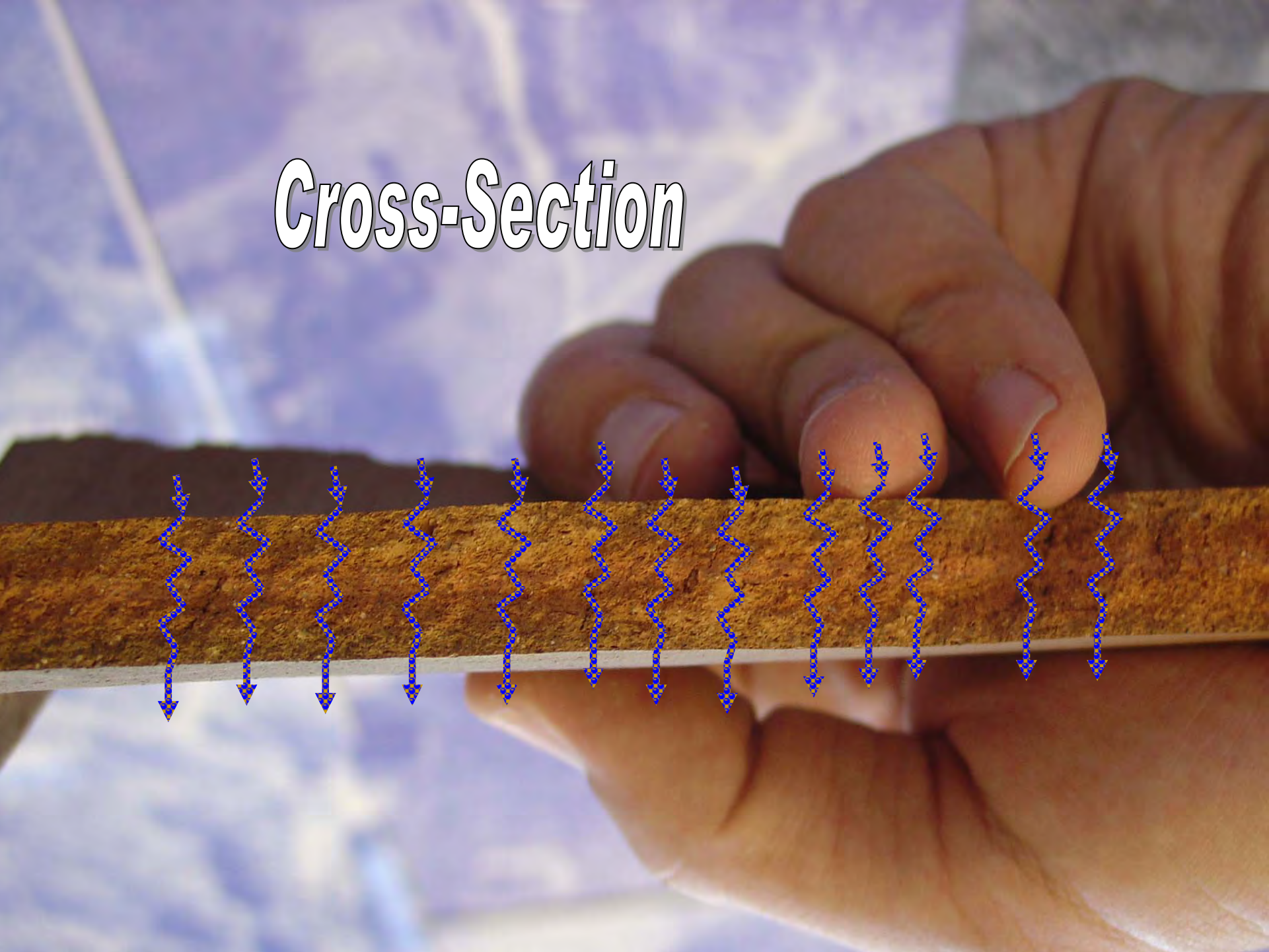


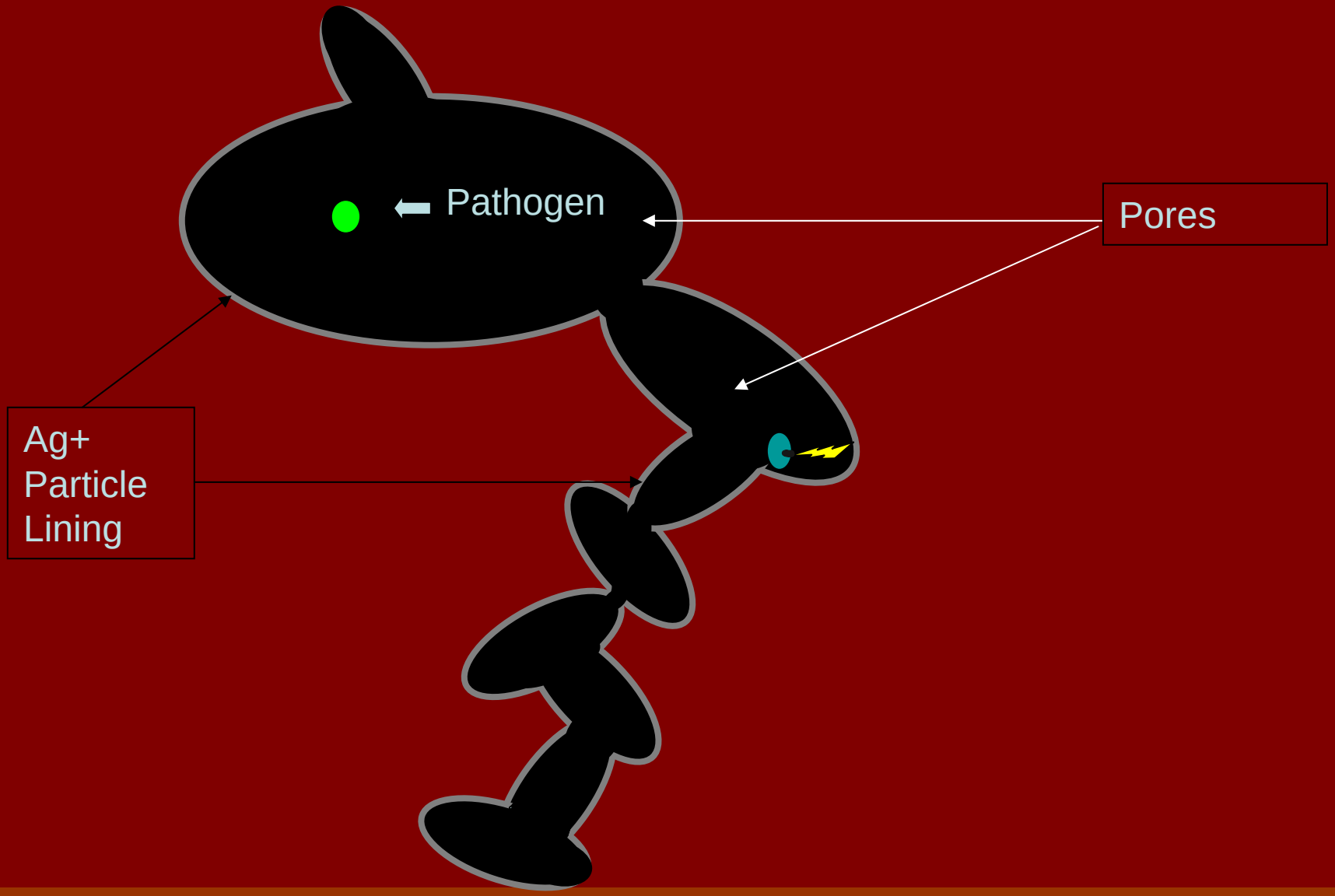
Figure 2. Comparison of relative sizes of various contaminants in water. Based on these, the pore size of the ceramic filter, at 0.2µm, would be about the size of a full stop on this page.



Cross-Section



Interactions With Ag Coating



Filter Processing - From Ideas to Markets

USAMI Ceramic Water Filter Research Leads to Start-Up in Nigeria

Ron Rivera and Staff at The Staff at Filtron Nigeria in Abeokuta, Nigeria

USAMI ceramic researchers have collaborated with Potters For Peace in the creation of a start-up (Filtron Nigeria)

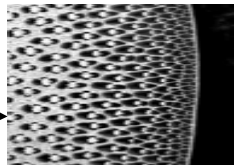
Filtron makes point-of-use ceramic filters that are fabricated from locally available clays and biodiversity such as wood chips and rice husks

Filtron is run by USAMI Visiting Fellow (Prof. Enock Dare) and 4 of his students who work with a team of 8 factory workers and 2 managers

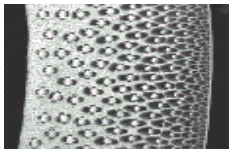
The production activities are also integrated with research efforts on the effects of porous structure on ceramic water filtration

Bamboo as an Intelligent Material - Plantation of Moso Culm and FGM Cross Section

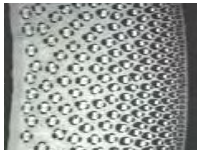
Top region



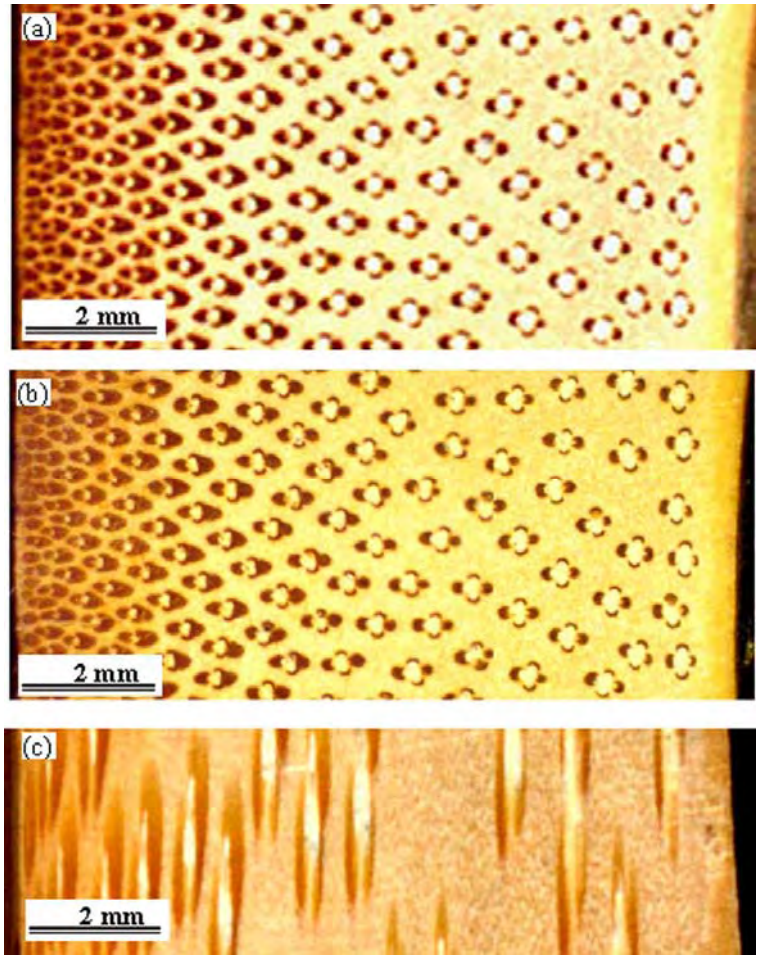
Middle region

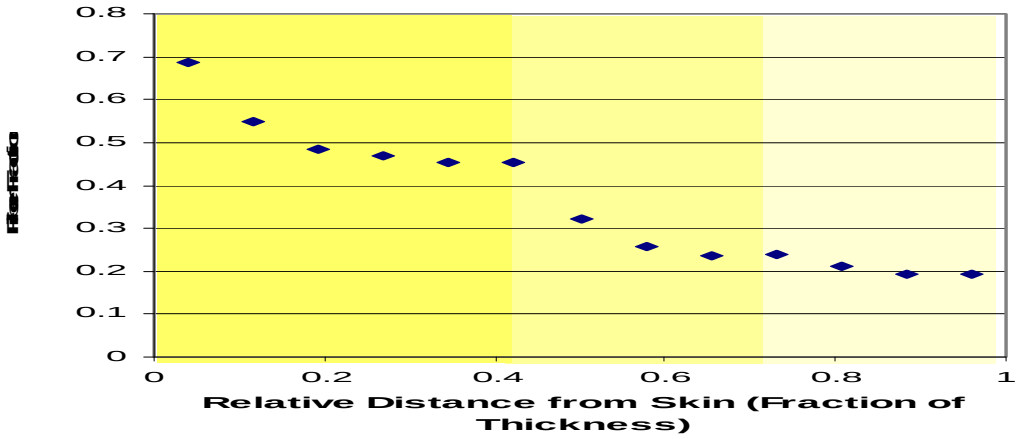


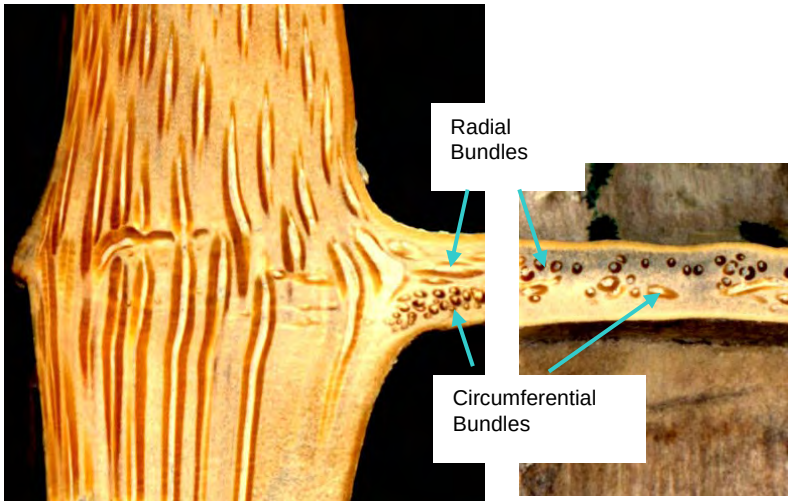
Bottom region



Scanned Images of Functionally Graded and Intelligentally Adapted Bamboo Structures



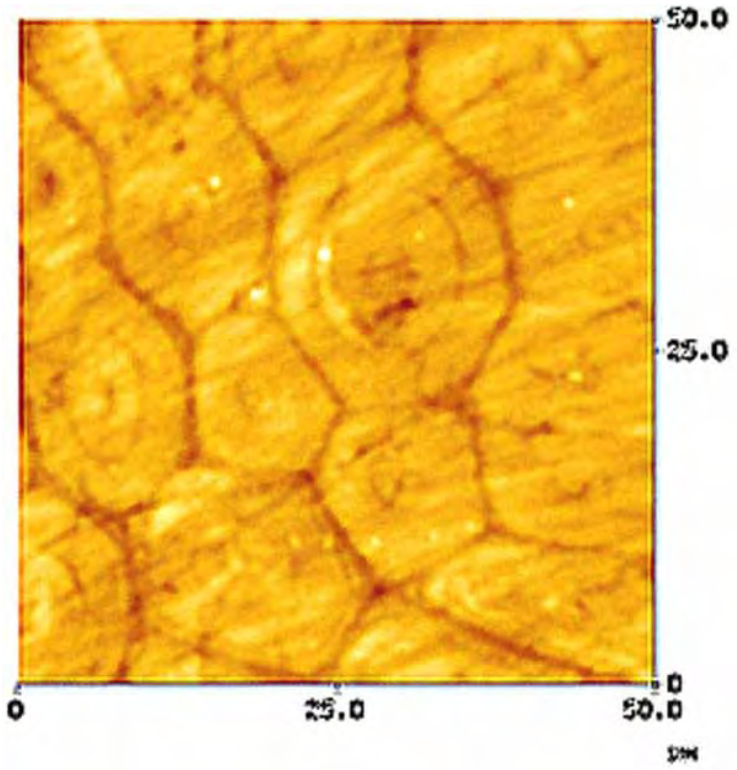




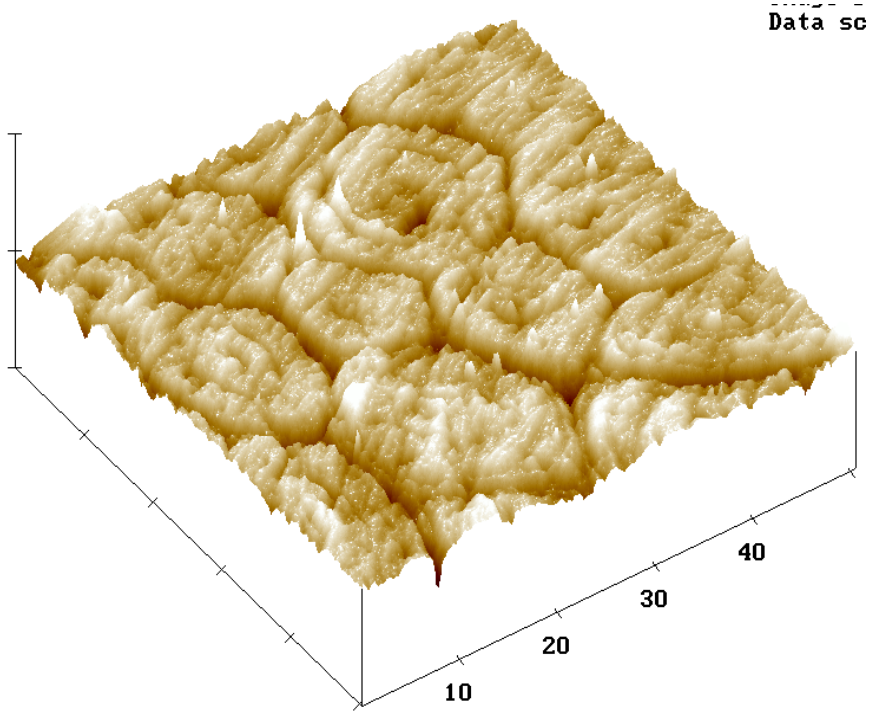
(a) L-R Cross section of the culm wall

(b) L-C Cross section of the diaphragm

AFM Scans of the Fiber Bundles



(a) Surface of vascular bundles in 2-D image



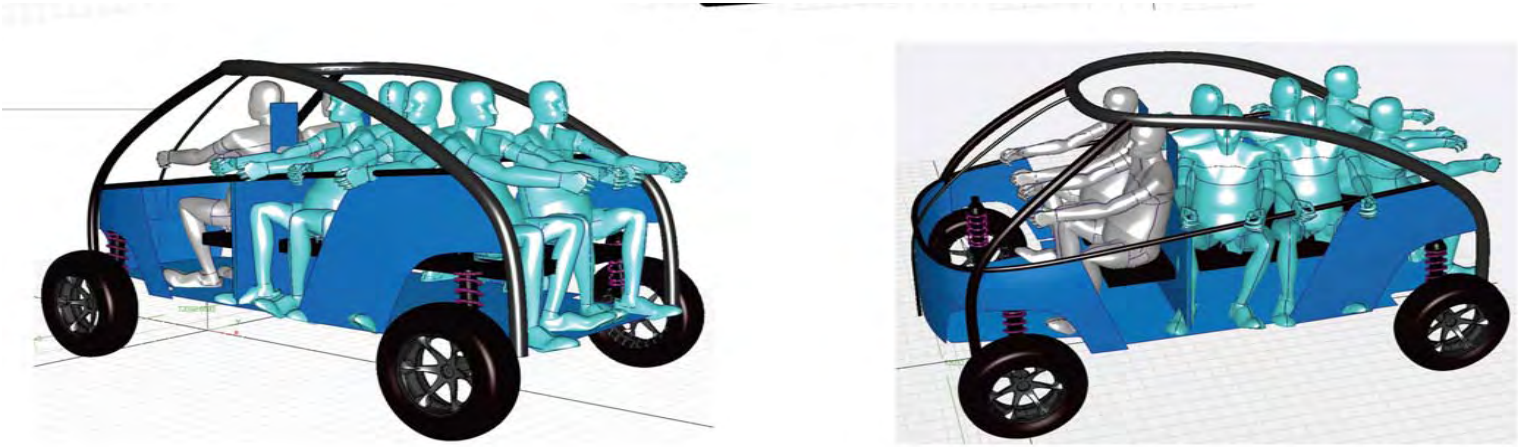
(b) Surface of vascular bundles in 3-D image

Bamboo Frame Bicycle

Nick Frey, Will Watts, Douglas Wolf, Tom Yersak

Conceptual Design of The African Bamboo Car

- Basic people mover concept – easy to construct
- Bamboo, leather and wood can be used
- Adaptable design for cargo and luggage space



Designer / Patrick Kiruki / K-Project

From Bamboo Bicycles to Future Transportation….

- Research is being initiated to go from bamboo bicycles to bamboo tractors, mopeds/motor cycles, cars and airplanes e.g. Brazil
- Research efforts should also be explored to transform agricultural wastes to biofuels
- Engines should be converted from gasoline to ethanol and other biofuels
- The goal should be to make African mopeds, cars and airplanes in the near future….

USAMI-IRC Summer Science Outreach Program

USAMI partnered with the **International Rescue Committee** to offer a science outreach program for about newly-arrived refugee youth

Through this 6-week summer program, Junior High and High School-aged children who once lived in refugee camps learned about science of water filtration and alternative energy by designing clay water filters and solar energy cookers

USAMI-supported undergraduate and graduate students also acted as mentors, giving insights into the American higher education process and application procedures

The 50 refugee students hailed from Sierra Leone, Liberia, Guinea, Burma, Nepal, Tibet and Iraq

Students engaged in campus tours and labs

The students also had the opportunity to visit Princeton University, where they were treated to lab and campus tours and had the chance to talk with Princeton students who were once refugees themselves

International Educational and Outreach Programs

- Faculty – Lou (Rice), Bhalerao (UIUC), Allameh (Kentucky), Rahbar (UMass), Shritriya (Iowa State)
- Graduate programs
  - Uganda (Obwoya), Nigeria (Oparinde, Olaiya-Segun), Brazil (de Melo)
  - USA (Bly, Thomas, Okwo, Agonafer, Delisser, Tong)
- Undergraduate programs (solar, housing, water)
  - Kenya (Sud, Davis, Rogers, Vocaturo, Nancy Rubenstein and Dan Rubenstein)
  - Tanzania (Sud, Davis, Cohen, Li, Vocaturo, Tesha)
  - Ethiopia (Lapetino, Asfaw)
  - Brazil (Sud, Huang, Ghavami and Savastano)
  - Nicaragua (Sud, Friedman)
  - Egypt (Bly, Cohen)
  - Burkina Faso (Piascowy)
  - Nigeria (Woodson, Friedman, Chen, Usoro, Leftwich)

US/Africa Workshops and Networks

- Organized US/Africa workshops in San Diego, Puerto Rico, Cairo, Cape Town, Abuja
- Developing linkages between the materials, manufacturing and modeling communities
- Helping to expand the role of Africa in the MWN
- Co-organization of US/Africa Implementation Meetings (with NSF and18 African governments)
  - Arlington/Princeton (2003)
  - Cairo (2004)
  - Abuja (2007)

MRS & African MRS Chapters

- Assisted with the memberships of 100 MRS membersips – continued by MRS for one year
- Assisted with the creation and activities of MRS Africa (Senegal, South Africa, Morocco, Dar-es-Salaam) and its 4 chapters
  - Eastern (Nairobi and Dar-es-Salaam)
  - Western (Akure)
  - Northern (Monastir)
  - Southern (Botswana)

USAMI Highlights

- Developed strong collaborations between US, African and Latin American universities (new research triangle)
- 90 research visits to the US and 90 journal publications
- Major contributions by US and African scientists
  - Nanoparticles and BioMEMS for cancer detection and treatment
  - Tissue interfacial engineering with RGD coating/microgrooves
  - Science-based reliability models MEMS thin films
  - Next generation of organic electronics (OLEDs and PVs)
  - Natural fiber composites for affordable housing
  - Viscoelastically toughened refractory ceramics
- International education/outreach and web-based educational modules
- Coordination of the African Scientific Committee of The Nelson Mandela Institutions

The Pan-African AIST Flower Model

New Opportunities For Networks

- The potential for synergy through collaboration
  - natural products, materials, marine science
  - Systems-based integration
- Exchange programs with African and international universities
- Exchange programs with African scientists in the diaspora e.g. African Scientific Committee (ASC)
  - Co-advising of students
  - Sandwich programs and sabbaticals

Funding Opportunities

- National Science Foundation
  - NSF International (Elizabeth Lyons/ elyons@nsf.gov)
  - NSF Materials World Network (Carmen Huber chuber@nsf.gov)
- Air-Force Office of Scientific Research
  - New Program in Materials (Wynn Sanders)
- University Programs
  - Princeton (Diana Davies)
  - University of Virginia
  - University of Texas
  - Rutgers University

Lessons Learned

- Motivate interdisciplinary research with clear goals and leverage resources
- Be inclusive without diluting goals
- Help to build networks that facilitate interactions e.g. Africa MRS, NOCMAT
- Develop professional structure for administration and transparent selection
- Integrate research and education to build critical mass (excellence in development)
- Explore models for entrepreneurship from research outcomes

Concluding Remarks

- Overview of international collaborations of the USAMI presented (usami.princeton.edu)
- Program supports 16 international scientists to visit collaborators in the U.S. (U.S., Africa & Americas)
- Systems-based interdisciplinary research approach-health, energy, housing and water
- Education and outreach in U.S., Africa and the Americas (Web-based modules available)
- Emerging networking opportunities – RISE, MWN facilitate knowledge diffusion & collaboration
- We welcome your involvement in shaping the future of USAMI (usami.princeton.edu)….

THANK YOU!