

An International Workshop on the Genome of Stone-based Civil Infrastructure Materials

Tiangong Mansion, University of Science and Technology, Beijing, China, June 8-9, 2016

Sponsored by US National Science Foundation, National Center for Materials Service Safety, Tsinghua University, and Tongji University

Evidence suggests that the successful mapping of the human genome may revolutionize the treatment of cancers and mental disorders amongst other ailments. A similar concept has been conceived for research and development in the study of engineering material. The Material Genome Initiative (MGI) which began in the United States in 2011 is seeking to develop a material innovation infrastructure and to incentivize a change in material design culture. The material "genome" can be described in terms of the material composition, the microstructure, and the inherent defects and can be determined by material characterization methods at multiple scales. Based on the measured material genome, multiscale mechanical models can then be established to evaluate the influence of the material genome on material properties. With the availability of high performance computational methods and tools, multiscale models based on actual composition and the microstructure of materials can help to speed up the material design process with a minimum of financial investment and labor costs. The ultimate goal of the material genome research is to be able to design materials of desired properties and performance by rational approaches. This has not yet been resolved for well-understood metallic materials and may be even more challenging to address for stone-based civil infrastructure materials, such as hydrated cement concrete, asphalt concrete, unbound aggregates, and human-augmented soil. These engineered hybrid natural-synthetic materials are important for the sustainable development of society, with significant potential impacts on both the economy and the environment.

Expanding concepts from the human genome to the material genome raises a number of questions, including: (i) what is the material genome? (ii) how can one identify the material genome and evaluate the influence of the material genome on material properties? and, (iii) how will understanding the material genome speed up discovery and innovation in material design?

An international workshop will be held at Tiangong Mansion of the University of Science and Technology Beijing, China, and will include the participation of leading researchers and educators in stone-based civil infrastructure materials to develop a roadmap to help answer these questions in a timely manner. The purpose of the international workshop on “The Genome of Stone-based Civil Infrastructure Materials” is to: (i) review and update the latest research and developments related to the genome of metallic and stone-based materials; (ii) identify technical barriers to developing international collaborations; (iii) promote the establishment of an international consortium for the identification of the genome for stone-based materials; and (iv) develop a roadmap for research and education in identifying and establishing a relationship between the material genome and the properties of stone-based infrastructure materials. The workshop will provide US



participants an opportunity to develop partnerships for future interactions with Chinese and European researchers.

Major Organizers:

Linbing Wang, Professor, Virginia Tech and Adjunct Professor, National Center for Materials Service Safety, USTB

David Frost, Elizabeth and Bill Higginbotham Professor, Georgia Tech

Zachary Greasley, Associate Professor, Texas A&M University

Dongbai Sun, Professor and Director, National Center for Materials Service Safety, USTB

Qingbin Li, Professor, Tsinghua University

Hehua Zhu, Professor, Tongji University

Minjing Jiang, Professor, Tongji University

Youyu Yang, Professor, China Geology University

Major Workshop Speakers:

Dr. James Warren, Technical Program Director for Materials Genomics Material Measurement Lab, US National Institute of Standards and Technology

Dr. David Cebon, Professor, Fellow, Royal Academy of Engineering, University of Cambridge, UK

Dr. Tom Scarpas, Professor, Technical University of Delft, the Netherlands

Dr. Imad Al-Qadi, Professor, University of Illinois at Urbana Champaign

Dr. Dallas Little, Professor, Texas A & M University

Dr. Bjorn Birgisson, Professor, Aston University, UK

Dr. Dongbai Sun, Professor, Director, NCMS, and Vice President, USTB

Dr. Chuangbing Zhou, Professor and President, Nanchang University

Dr. Yabo Zhao, Professor, Chinese Academy of Sciences

Draft Agenda for the Two-Day Workshop

Day One

8:00 -8:15 Welcome Speech, Dr. Dongbai Sun

8:15-8:30 Workshop Introduction, Dr. Linbing Wang

Session I

8:30-9:15 Human Genes and Genetic Research for Clinical Practices of Human Diseases

9:15-10:00 Nugget Presentations (3)

10:00-10:15 Break

Session II

10:15-11:00 “Genome” of Engineering Materials (Theme Report)

11:00-12:00 Nugget Presentations (3)

12:00-1:00 Lunch

Session III

1:00-1:45 Integration of Multiscale Microstructure into Multiscale Modeling and Simulation (Theme Report)

1:45-2:30 Nugget Presentations (3)

2:30-2:45 Break

Session IV

2:45-3:30	Relationship between Material “Genome” and Material Properties for Stone-Based Infrastructure Materials (Theme Report)
3:30-4:15	Nugget Presentations (3)
4:15-4:30	Break
4:30-5:30	Brainstorming Discussions: Industrial Support and Sustainability
6:30-8:00	Dinner

Day Two

Session V

8:30-9:15	Multiscale Modeling Simulations on High-Performance Computation Platforms (Theme Report)
9:15-10:00	Nugget Presentations (3)
10:00-10:15	Break

Session VI

10:15-11:00	Perspectives for Material Design (Theme Report)
11:00-12:00	Nugget Presentations (3)
12:00-1:00	Lunch
1:00-3:00	Brainstorming Discussions: International Collaboration and Sharing Resources for Research and Collaboration
3:00-3:30	Break
3:30-4:30	Brainstorming Discussions: Roadmap for Research and Education on Genome of Stone based Infrastructure Materials
4:30-5:00	Concluding Remarks, Dr. David Frost
6:30-8:30	Workshop Banquet

Please send the following information to Dr. Linbing Wang at wangl@vt.edu or Dr. David Frost at david.frost@ce.gatech.edu. Submissions prior to March 16, 2016 will receive full considerations.

1. Your 2-page resume in NSF format;
2. One page abstract of your presentation relevant to the theme topics.

Selected participants will be offered an NSF fellowship of \$1000 for partial travel support. Five to six participants in each subject area of cement concrete, asphalt concrete and human augmented soils will be selected based on relevancies of his or her abstract, and research background. Participants will also receive meals and accommodation supports from the universities of the Chinese organizers.

Underrepresented groups and young faculty members will be given favored considerations. Selected participants will be also invited to attend the Transportation Research Congress (TRC), June 6-8, 2016, the National Convention Center, Beijing (www.trc-c.org).

