A Perspective on MGI Networking

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Concept of a Network for Materials Innovation – “Accelerator Network”

In Existence: National Nanotechnology Infrastructure Network

Broad scope of MGI is too large for single institutions – networking is essential for both capital and human resources. Transformation of education and collaborative work also key.

Is there a need for a NMIN (National Materials Innovation Network)? What would it look like?

http://www.nnin.org/
Likely Elements of MGI Networking

- Information infrastructure
- Educational infrastructure
- Shared facilities infrastructure
Basic Concept of MGI

- Natural emergence from DARPA AIM, ICME, NSF Cyberdiscovery, etc.
- Enhancing the rate of materials innovation and deployment

“half the time at half the cost”

Obama Administration MGI announced June 2011
Limitation in Inverse problems

Continuum

Mesoscale

Atomistic

Quantum

Microstructure Taxonomy

**Structural Materials**

- **Materials Development**
- **Materials Selection**

**Microstructure (Genome) - NEW**

**Properties (Materials Selection) - OLD**

Olson, 1997
Ni-base superalloys for aircraft gas turbine engines

Dr. L. Christodoulou

Critical Aspects for Universities

• **Innovation infrastructure** (shared resources and cyber infrastructure for materials data, analytics, and decision support), coordinated with National Labs and major university-based user facilities.

• Cultivating interdisciplinary **exploration** of emerging research themes in the critical path (e.g., mesoscale science, scaling, validated modeling protocols, 4D experiments, high throughput methods).

• **Strategic engagement** with industry.

• **Complementary relations** among stakeholders to establish MGI “network”.

GT Initiative... IMat
Materials Innovation Ecosystem @ GT

- Societal Impact – mobility, energy, health, infrastructure, communications, security
- Economic Impact – future workforce, 21st century economy

Materials and “X”

Over 200 materials-related faculty
**Vision:** To be an international leader in the research, development, and innovative use of materials to solve scientific and technological grand challenges.

**IMat: Materials Innovation Ecosystem @ GT**

- **Executive VP Research**
- **Executive Director, IMat**
  - Center Manager, Communications
  - Industry/Business Liaison, Financials
- **Innovation Initiatives**
  - X-materials – MGI
  - MatIN
  - Workshops, Short Courses
  - Strategic Industry Relations
- **Shared Resources**
  - Distributed facilities
  - Web portal, search/access
  - Teaming

**Use-Inspired Research**

- **Academic & National Lab Partners**
- **Basic Materials Research**
- **Industry Partners**
- **Products, Applications**
- **Cabinet, Student & Post Doc Council, External Advisory Panel**
Some Implications of MGI → IMat

• Systems integration – building engineering and science bridges between materials and manufacturing
• Integration of materials characterization, modeling, experiments, and databases with data sciences/big data → high throughput is a focus
• Testbeds for collaborative MGI concepts across disciplines and with industry/labs, including educational and workforce programs
• Workshops, seminars, study groups as necessary to support MGI development and implementation
IMat was formally launched June 24, 2013 in a press release from White House OSTP related to the 2nd anniversary of the Materials Genome Initiative.
Materials Innovation Infrastructure

- Materials discovery - first principles & atomistics
- UQ and uncertainty management
- Verification and Validation - Experiment/Model coupling
- Unit process models for manufacturing
- Sensors and in situ measurements
- Materials characterization and microstructure representation

Hierarchical and concurrent multiscale models
  * process-structure
  * structure-property

Designer Materials Knowledge System

Decision-based multiobjective systems design
  - Design exploration
  - Detail design
  - Data sciences and material informatics

Computational Tools

Experimental Tools

Digital Data

Databases

Expanded by DLM from OSTP Materials Genome Communication
http://www.whitehouse.gov/sites/default/files/microsites/ostp/materials_genome_initiative-final.pdf
Components of the Materials Innovation Network MatIN at Georgia Tech.

COLLABORATION NETWORK

CODE REPOSITORY

DATABASE  Data, metadata, workflows

INITIAL APPS  Correlation functions for microstructures

S. Kalidindi, A. Fast
Opportunities for Engagement

**GT Activities: Networking, Partnerships**

- March 28, 2014 SE USA regional workshop hosted by Georgia Tech
- MGI materials innovation accelerator network (June 5-6, 2014) – IMat hosting at Georgia Tech with co-organizers UW-Madison and Univ. Michigan