# Fact Sheet:  Materials Innovation
# Materials Genome Initiative Turns Two

June 24, 2013

Two years ago today, President Obama launched the Materials Genome Initiative (MGI), committing the Nation to doubling the pace of advanced materials discovery, innovation, manufacture, and commercialization. Accelerating the development of new high-tech materials promises to revolutionize domestic manufacturing while addressing a broad range of national goals in such diverse domains as energy, health, transportation, food and agriculture, and national defense.

A primary goal of the MGI is to catalyze greater collaboration across the advanced materials workforce, including Federal agencies, industry, professional societies, and academia. Just as the open sharing of DNA sequence data accelerated the Human Genome Project and fueled a rapid economic expansion in biomedical applications, the MGI aims to speed the creation and deployment of new materials through enhanced public-private coordination and greater access to instrumentation, modeling and simulation tools, and pre-competitive data that describe materials properties and behavior. And materials scientists are responding. What started out as a modest investment of ~$63 million involving just four Federal agencies in 2012 has grown into a multi-stakeholder endeavor valued at hundreds of millions of dollars involving universities, companies, professional societies, and individual scientists and engineers—as well as additional Federal components—working together to develop policies, resources, and infrastructure in support of advanced materials.

In coordination with the MGI's second anniversary, a number of agencies, universities, and companies announced new commitments today. Among them:

## *New Stakeholder Commitments*

**University of Wisconsin-Madison Invests $5 million+ in New Institute for Materials**
Building on industrial, governmental, and university relationships and expertise in such areas as computational materials science, data analysis, experimental-tools development, and materials synthesis and characterization, the University of Wisconsin-Madison College of Engineering will pledge an initial investment of $5 million to create the Wisconsin Materials Innovation Institute. This cross-disciplinary technological hub will provide infrastructure for the materials community, create synergy among a broad range of researchers, and enable those researchers to create innovative methods, materials, and new scientific directions that will enable U.S. manufacturing competitiveness.

**Georgia Institute of Technology Launches New Institute for Materials**
Georgia Tech is announcing the launch of a new Institute for Materials (IMat), an interdisciplinary research institute designed to foster a materials innovation ecosystem for research and education.  This new institute is part of a $10 million commitment over the next five years toward building a stronger materials innovation ecosystem. One IMat initiative is to

develop a collaborative hub that combines elements of data sciences and microstructure characterization to support accelerated materials development.

Later this year, the **University of Michigan—**which is on track to invest an additional $20 million over the next few years to build on its new UM Center for Integrated Computational Materials Engineering and a soft-matter modeling and simulation "Assembly Lab"—will join with **Georgia Tech** and **UW-Madison** to initiate a multi-stakeholder national dialogue on the formation of a national materials innovation accelerator network as a component of the Materials Genome Initiative.

**Harvard Debuts Database of 2.3 Million New Materials for Clean Energy**
Led by a team from Harvard University and IBM, researchers with the Clean Energy Project are releasing a new searchable database of computationally derived materials properties for 2.3 million organic molecules of potential use in organic solar cells. This is a follow-up on a commitment announced at the White House in 2012. This collection of nearly 400 terabytes of data is one of the largest sets of computational materials science data ever assembled and will help users find molecules that meet their specific research or commercial requirements. The database will be accessible to the research community and public at MolecularSpace.org. The data are being generated through volunteer distributed computing. In the spirit of crowdsourcing, users will be able to interactively design new material candidates.

**Professional Societies Find Large Majority Favor Open Access to Materials Data**
The Materials Research Society and the Minerals, Metals and Materials Society jointly conducted a survey of the broad materials community on access to materials data—an issue critical to the advancement of the MGI. Over 650 materials experts participated in the survey, with three-quarters saying they would participate in open data sharing if encouraged as a term/condition of funding or publication. This willingness is a positive indicator for the data-sharing elements of the MGI and aligns with recent White House actions relating to scientific publication, data management, and open data to enhance sharing of scientific data. Detailed survey results will be published soon via the MRS and TMS websites, publications, and e-newsletters.

**Public-Private Effort to Accelerate Materials Discovery and Development**
The Materials Project, an open-platform webtool to predict material behavior hosted at DOE's National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory (LBNL) in collaboration with MIT, is working with Intermolecular, Inc., to improve the tool's predictive capabilities for industrial and academic users. This effort will dramatically accelerate the transition of new material discoveries into practical applications, using advanced "combinatorial" experimentation techniques. In recent years, advances by Intermolecular have leveraged these same techniques to accelerate advanced materials and device development more than 10-fold over conventional experimentation. In this new effort, data from Intermolecular's high-throughput combinatorial experimentation and characterization toolset will be provided to the Materials Project for the development of better predictive materials models. These tools will be openly available to the scientific community through the Materials Project.

**MIT Launching MOOC on Innovation and Commercialization of Materials Technologies**

MIT is launching a new free, online course focusing on innovation and commercialization in material science. The course shows how focusing on finding the right problem and considering innovation and commercialization issues early on can enhance innovative outcomes and productivity—keys to achieving MGI's goal of accelerating the time to market for new materials.

**Eight New Commitments to Education and Workforce Training**
Today, seven universities are announcing new commitments in support of MGI workforce training goals through the development of new degree programs, facilities, and teaching tools. For example, Georgia Institute of Technology is developing plans through the School of Materials Science and Engineering to offer a new graduate certificate program in computational materials and big data to prepare its students to use the new research paradigm enabled by MGI; North Carolina State University is debuting a new online graduate degree program focused on using nanoengineering and nanomaterials to develop new technologies. The Lehigh University Department of Materials Science and Engineering is creating a new state-of-the-art teaching facility to enable hands-on, integrated experimental and computational learning experiences for its students. And Johns Hopkins University is committing to release the computational materials teaching modules it has developed and tested in its undergraduate courses. Also in the educational domain, Autodesk is making new cloud-based simulation software available free-of-charge to educators and students.

**5 Universities Take the Lead on Organizing Regional Stakeholder Meetings to Propel MGI's Impact**
Five universities from different regions of the country are working to bring together local academic researchers, technology-transfer professionals, materials research and development leaders from industry, and government science and technology officials to advance the goals of MGI. The meetings will promote collaboration to boost regional economies and provide input to Federal MGI leaders on future directions for the initiative. On October 8, Northeastern University will host the first of these meetings in Boston, MA, assembling key New England stakeholders. The University of Southern California plans to host a meeting for California stakeholders in November, and Rice University will hold a meeting for Southwestern stakeholders in December. The University of Illinois and Georgia Institute of Technology are also organizing meetings for the Midwest and Southeast regions planned for the spring of 2014.

*New Federal Commitments*

**NIST Announces $25 million for New Center of Excellence**
The Commerce Department's National Institute of Standards and Technology (NIST) will launch a competition to form a $25 million Center of Excellence on Advanced Materials. The goal of this new center is to create a collaborative environment and concentration of technical capability to accelerate materials discovery and development, provide opportunities to transition new breakthroughs in advanced materials to industry, and offer training opportunities for young scientists and engineers. Through the integration of data, models, and experiment, the Center will provide the technical tools US industry needs to be first to market with the advanced materials that enable breakthrough products. Industry, academic, and government researchers working at the Center will collectively identify critical technical barriers to progress on a wide range of advanced materials research topics.

**NIST/ASM Announce Collaboration on Structural Materials Data Demonstration Project**
NIST and ASM International—through ASM's Computational Materials Data Network—will establish an open, digital repository of materials data using demonstration datasets for the materials digital data community. This will provide an opportunity to pursue new research endeavors through the use of data analytics, as well as identify challenges and solutions in materials data management that can be tested by the wider materials community.

**DARPA, US Army, and NASA Partner on Data Infrastructure**
The Defense Department's (DoD) Defense Advanced Research Projects Agency (DARPA) has initiated a collaboration with the US Army and NASA to use the highly successful MSAT/MAPTIS data management system to capture and store data from manufacturing research directed by DARPA's Open Manufacturing Program. After a standardized verification and validation process, these manufacturing data will become available to the entire MAPTIS community, including academic and industry researchers.

**DOD Expanding its Leverage of MGI**
DoD has increased its emphasis on basic and applied research projects important to national security that contribute to the goals of the MGI, particularly in the areas of Integrated Computational Materials Engineering. For example, DOD recently announced its interest in launching a Lightweight and Modern Metals Manufacturing Institute, which would focus on strengthening domestic metals manufacturing, accelerating time to market of competitive products for the military and civil sectors, and augmenting the tools and education for the next-generation professional workforce—bridging advanced materials, manufacturing, and education as envisioned by the MGI.

**DOE Building on FY12 Investments to Advance MGI**
The Vehicle Technologies Office within the Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy, in collaboration with NIST, will soon be announcing $3 million in new awards for its recent solicitation on advanced lightweight metals. Moreover, the DOE Basic Energy Sciences (BES) Program has an active university and national laboratory research portfolio in Predictive Theory and Modeling, with 19 awards made in FY 2012. In FY 2013, BES selected Argonne National Laboratory to lead the Joint Center for Energy Storage Research, which will apply MGI principles to the discovery and design of new electrolytes to move beyond traditional lithium-ion batteries.

**DOE and NSF Research Facilities Advance Support for MGI**
The National Science Foundation (NSF) Materials Research Facilities Network is a network of shared experimental facilities and technical experts distributed across 26 research institutions Since the launch of the MGI, the Network has added 200 new instruments that support the goals and objectives of the MGI —a 25% increase in capacity, complemented by a more streamlined, searchable, web-based system for academic and industry-based users. The DOE BES also supports scientific user facilities for x-ray, neutron, and electron scattering for materials characterization. In particular, five Nanoscale Science Research Centers (NSRCs) offer state-of-the-art capabilities for materials synthesis, in-situ characterization, and theory/modeling that are

directly relevant to advancing the MGI goals.  DOE is in the process of establishing a web-based gateway that features the expertise, instrumentation, and capabilities at all five of the NSRCs in a common framework.

**Smithsonian Associates to Focus on Materials**
In response to the MGI, the Smithsonian Associates, the Institution's cultural and educational division, is developing a fall 2013 program focusing on advanced materials. This program will feature an overview of the evolution of advanced materials, as well as a discussion by leading researchers on recent discoveries and the potential they hold for new cutting-edge applications.