

## **Institute for Materials (IMat)**

### **Description of IRI**

Georgia Tech's Institute for Materials is an international leader in defining and enabling the integration of experiments, computation, and data science in materials research and development to address 21<sup>st</sup> century scientific and technological grand challenges with significant global economic and societal impact. IMat fosters the development of a Materials Innovation Ecosystem through shared resources and innovation initiatives to accelerate discovery and development of advanced materials.

IMat pursues three high priority goals:

1. Fostering further development of a cross cutting *materials innovation ecosystem* at Georgia Tech that leverages e-collaborative materials discovery, design, and development to flesh out the electronic laboratory of the future for materials research.
2. Promoting Georgia Tech's leadership position in novel experimental techniques and methods for materials synthesis, processing and characterization at multiple scales, including high throughput methods and coupling with computational simulation and data science.
3. Further enhancing Georgia Tech's recognition as an interdisciplinary leader in novel pathways to prepare the future workforce for materials innovation.

IMat adds value to the campus materials research and education community and to the overall innovation ecosystem at Georgia Tech in the following specific ways:

1. Linking campus materials research facilities and administering the joint IEN/IMat Materials Characterization Facility.
2. Promoting networking and collaboration in cross cutting research and education aspects of materials discovery, design, and development to foster disruptive innovation, with value-added emphasis on the emergent role of materials data science and informatics.
3. Building strategic partnerships with industry, academia, and government.
4. Supporting development of cross cutting research teams and proposals.
5. Projecting global thought leadership in advancing a *materials innovation ecosystem*.

### **Core Strength Areas in Materials Research**

IMat fosters a *materials innovation ecosystem*, designed to support and enhance the pace of collaborative materials discovery and development. IMat supports research program development that encompasses numerous areas of innovation in materials research, spanning metallic, ceramic, and polymeric materials, as well as composites. Some core strengths include:

- Catalytic materials
- Electrochemical energy storage and conversion
- Structural Materials
- Bio-inspired Design
- Bio-mediated and Bio-inspired materials
- Cellulosic Nanomaterials
- Georgia Tech Polymer Network
- Materials for Propulsion
- Materials in Extreme Environments
- Multiscale Sciences in Materials Discovery and Development
- Soft Matter
- Tissue Repair and Regeneration

## **Organizational Structure**

IMat represents the interests of nearly 200 materials research faculty, with about 75 faculty from CoE and CoS considered as most active as in IMat programs and use of shared facilities. IMat management consists of:

- Executive Director – David McDowell
- Deputy Director, Innovation Initiatives – Jud Ready
- Associate Director, Shared Resources – Eric Vogel
- Innovation Strategist – Surya Kalidindi
- Center Manager – Cecelia Jones
- Marketing & Communications – Kelly Smith
- Finance (interim) – Rusty Edwards
- Industry Liaison – Brooke Beckert
- Administrative Support Specialist -- Farlenthia Walker

IMat also includes an eleven-member external advisory panel; a materials faculty cabinet; faculty support for innovation; and a student advisory council.

## **Facilities & Resources**

IMat has a limited footprint with seven rooms (1760 sq. ft.) and lobby/reception space in the Paper Tricentennial Building (second and fourth floors) for management offices, meetings, and materials information infrastructure for visiting industry/faculty. With the exception of the materials characterization facility (MCF), as described further below, space devoted to materials research is managed by the individual researchers and their home academic units.

### *Equipment & Facilities*

#### Materials Characterization Facility (MCF)

The Institute for Materials and the Institute for Electronics and Nanotechnology (IEN) jointly manage a shared-access Materials Characterization Facility (MCF) available to GT users and non-GT users from academia, industry and government agencies on an hourly rate basis.

The MCF shared-user labs house more than 20 high-end microscopy, spectroscopy, and diffraction tools for measuring a wide variety of materials and structures. Included in these major tools are 5 SEM's, 4 TEM's, 3 XRD's, 2 XPS systems and additional instruments for surface science, scanning probe microscopy, and optical spectroscopy/measurement. The MCF also has a fully-outfitted lab for sample preparation of hard materials. Details on each of the instruments can be found at: <http://mcf.gatech.edu>.

The MCF is headquartered in the Marcus Nanotechnology Building on the GT campus in Atlanta, Ga., and its instruments are available 24 hours/day, 7 days/week on a first-come/first-served scheduling basis. The full-time staff, which has an average of ~20 years of experience in microscopy and characterization, provides comprehensive consulting, training, and analysis assistance to more than 500 users annually.

## **Accomplishments**

### *Proposal support and cross cutting program accomplishments*

Since 2012, IMat has supported the preparation and submission of external research proposals for major cross cutting center-level awards, often in collaboration with other IRIs and the Office of Industry

Collaboration. IMat helped to pioneer ‘ideation research projects’ (IRP) that bring together faculty for brain storming sessions devoted to solving industry-relevant problems funded by external companies and organizations.

Since 2012, IMat has:

- ✓ Established the Materials Characterization Facility (MCF) ([www.mcf.gatech.edu](http://www.mcf.gatech.edu)) with 500 active users, 132 active Georgia Tech PIs, and 17,000 hours of usage in 2016 to achieve effective and efficient utilization of distributed shared resources for materials research that enhances productivity.
- ✓ Worked with the EVPR to acquire new high resolution TEM, upgraded TEM specimen preparation, in situ TEM, and XRD facilities, helping to define and created new areas of leadership in experimental capabilities and cyber-infrastructure. New and upgraded equipment the past two years includes:
  - Hitachi HD-2700 Scanning Transmission Electron Microscope
  - Createc Ultra High Vacuum Scanning Tunneling Microscope
  - Panalytical Empyrean X-ray Diffraction System
  - Comprehensive imaging and upgrade package – on Kratos XPS
  - Gatan One-View high framed rate camera – on FEI Tecnai TEM
  - Oxford Omicron micromanipulator – on FEI Nova FIB/SEM
  - Nikon Optical microscope for sample preparation
- ✓ Invested in development of the e-collaboration platform MATIN ([www.matin.gatech.edu](http://www.matin.gatech.edu)) and worked with the EVPR to internally seed fund the IDEAS:MD<sup>3</sup> materials data science institute ([www.materials.gatech.edu/ideas-md3](http://www.materials.gatech.edu/ideas-md3)), adding considerable value to the pace of basic research and translation to applications.
- ✓ Hosted 25 workshops, 13 seminars and materials innovation lectures, administered three years of competitive seed funding programs, supported a number of white paper competitions, and supported development of a number of cross cutting materials research proposals. Inspired, created, and promoted cross cutting teams across colleges and GTRE by supporting large scale, cross cutting proposal development, including organizing meetings and providing writing and illustration services.
- ✓ Provided novel pathways for strategic engagement of industry and national labs with materials research and education programs at Georgia Tech, such as the Sandia Academic Alliance partnership.
- ✓ Integrated elements of materials science and other disciplines within the overall materials innovation ecosystem to develop and offer first-to-market Massive Online Open Courses (MOOCs) in high throughput materials development and materials data science and informatics launched by IMat in 2016.
- ✓ Provided leadership in federal initiatives to accelerate materials discovery and development such as the U.S. Materials Genome Initiative (MGI) through communication of Georgia Tech’s novel position in advancing a *materials innovation ecosystem* with publication of highly visible thought pieces in leading materials journals, hosting regional and national MGI workshops, and co-founding the Materials Accelerator Network ([www.acceleratornetwork.org](http://www.acceleratornetwork.org)) with the University of Wisconsin-Madison and the University of Michigan.