TECHNOLOGY INNOVATION PROGRAM
National Institute of Standards and Technology
Gaithersburg, MD 20899

ADVANCED TECHNOLOGIES FOR MANUFACTURING

The Technology Innovation Program (TIP) at the National Institute of Standards and Technology (NIST) was established to assist U.S. businesses and institutions of higher education or other organizations, such as national laboratories and nonprofit research institutions, to support, promote, and accelerate innovation in the U.S. through high-risk, high-reward research in areas of critical national need. These areas need government attention because the magnitude of the problem is large and societal challenges are not being sufficiently addressed. Manufacturing due to its criticality to the Nation has been an early area for TIP investment. As a result, TIP has been able to foster critical partnerships with industry to advance its mission in the manufacturing sector.

In 2009, TIP published a white paper describing the scope of its first solicitation in Manufacturing – "Accelerating the Incorporation of Materials Advances into Manufacturing Processes." The 2009 competition in manufacturing focused on advanced materials in manufacturing addressing the challenge of accelerating the development of new materials in three specific classes (nanomaterials, composites, and metals, alloys and smart materials) and developing the manufacturing technologies needed to incorporate these materials rapidly into new products. In 2010, TIP held a second competition in the manufacturing area expanding the scope of the first solicitation to include critical manufacturing process advances and additional classes of materials (glasses and ceramics). TIP published the white paper "Manufacturing and Biomanufacturing: Materials Advances and Critical Processes" to describe this expanded the scope of the 2010 Manufacturing competition. The areas called out in the solicitation follow:

- *Process scale-up, integration, and design for advanced materials.* New materials typically are developed in a laboratory setting, and then samples are given to end-users for alpha and beta testing. Scaling-up from laboratory quantities to larger volumes, integrating these processes together, and then incorporating them into product manufacturing lines is often complex and requires substantial research to move from one scale to another.

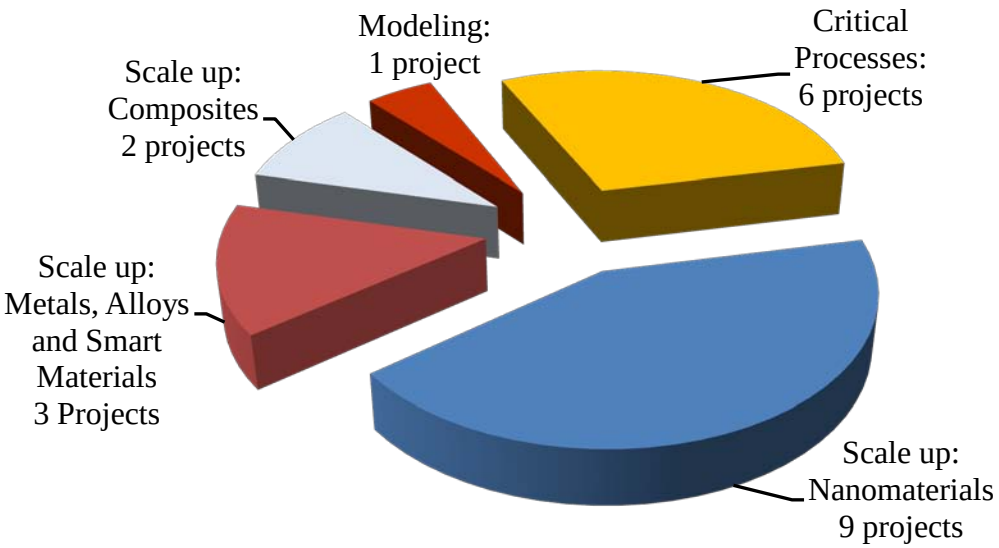
- *Predictive modeling for advanced materials and materials processing.* Predictive modeling capabilities are key to developing new processes, scaling-up these processes and understanding how to utilize an advanced material's unique functionality.

- *Critical process advances related to the manufacturability of materials and the manufacture of both new and existing products*. Critical processes are generally manufacturing processes that have the greatest impact on one or more of the following characteristics: product quality, product yields from raw materials, scrap rates, efficiency of raw material consumption, and/or other measures of efficiency.

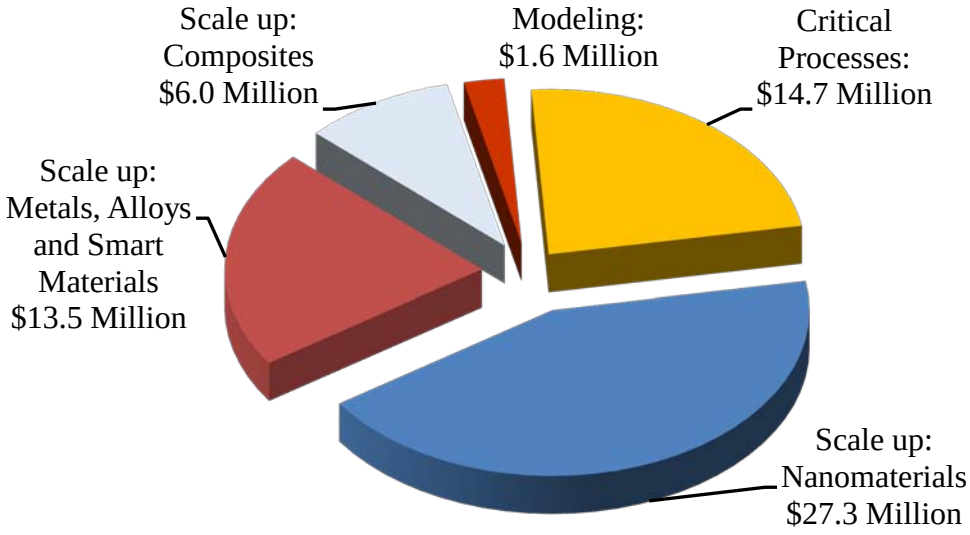
In two competitions, TIP received 173 proposals with over 350 different participants from 38 states, the District of Columbia and Puerto Rico indicating the level of interest in the program topic. These proposals included more than $540 million in non-Federal matching funds demonstrating the importance that industry places on these areas to remain competitive.

On December 15, 2009, TIP announced 12 awarded projects from the 2009 competition, and on December 15, 2010 TIP announced 9 awarded projects from the 2010 competition. Over the life of these awards, the 21 awarded projects represent a total investment of $130 million in new research including $63 million of TIP funds and $67 million of cost-shared funds to be provided by the awardees.

TIP awarded projects in the following topic areas:



TIP funding was invested as follows:



2009 Projects:

A123Systems, Inc. (Ann Arbor, MI) plans to develop a new composite nanomaterial for lithium-ion battery cathodes for significantly increased battery performance together with improved manufacturing techniques to lower overall costs.

Amprius, Inc. (Menlo Park, CA) plans to develop a unique, high-throughput, continuous manufacturing process for producing a novel, nanostructured silicon-based anode material for lithium batteries.

Angstron Materials, LLC (Dayton, OH) plans to develop processes for mass-producing chemically modified ("functionalized") nano graphene for next-generation products, particularly for the energy industries.

Brewer Science, Inc. (Rolla, MO) plans to develop technologies for the cost-effective production of high-purity, high-quality, metallic and semiconducting carbon nanotube 'inks' to enable commercial production of a wide variety of high-performing electronic devices for energy, flexible electronic and sensor applications.

Go to http://www.nist.gov/tip for more information

Ebert Composites Corporation (Chula Vista, CA) plans to develop a state-of-the-art manufacturing process to automate, on a large scale, the production of three-dimensional fiber composites with high temperature thermoplastics.

eSpin Technologies, Inc. (Chattanooga, TN) plans to develop a commercial-scale manufacturing process for producing self-supporting, non-woven fabrics of both natural and activated carbon nanofibers.

Hyper Tech Research, Inc. (Columbus, OH) plans to develop a practical, industrial scale continuous manufacturing process for magnesium diboride superconducting wires and other wire products requiring a hollow metal tube around a powder-based core.

Liquidia Technologies, Inc. (Durham, NC) plans to scale up to practical commercial volumes a novel nanoparticle manufacturing process based on nanoscale molding to produce engineered nanoparticles of specific sizes, shapes and materials for therapeutic applications.

Pixelligent Technologies, LLC (College Park, MD; Joint Venture Lead) plans to develop new processes and technologies for scaling up the production of high quality nanocomposites, by incorporating nanocrystals with precisely controlled size, shape, and surface chemistry into a polymer matrix for demanding and high-volume industrial applications. (Partner: Brewer Science, Inc.)

Third Wave Systems, Inc. (Minneapolis, MN) plans to develop and demonstrate integrated multiscale physics-based predictive modeling for developing more machinable advanced alloys and the corresponding component machining processing data.

University of Wisconsin (Madison, WI; Joint Venture Lead) plans to develop a novel casting technology, based on ultrasonic cavitation dispersion of nanoparticles in metal melts, for large-scale production of aluminum and magnesium matrix nanocomposites. (Partners: Eck Industries, Inc.; Nanostructured & Amorphous Materials, Inc.; Oshkosh Corp.)

wTe Corporation (Bedford, MA; Joint Venture Lead) plans to develop and scale-up to commercial levels a suite of novel, optoelectronic inspection technologies to accurately identify and sort aerospace metals such as titanium and nickel/cobalt superalloys at ultra-high speeds so they can be recycled more cost effectively and also to enhance melting capacity for existing furnaces by measuring composition in-situ, in real time. (Partners: National Recovery Technology; Energy Research Company)

2010 Projects:

ACell, Inc. (Austin, TX) plans to develop technology necessary to scale up production of the company's novel nanocomposite material for high-performance lithium batteries by a factor of a thousand, potentially enabling safe, powerful and economical batteries for electric vehicles and other demanding applications.

Arsenal Medical, Inc. (Watertown, MA) plans to develop processes to increase production of drug-filled, hollow fibers to rates necessary to enable commercially viable use of these fibers in devices and products for drug delivery, tissue engineering, nanoscale sensors and other applications.

Engineered BioPharmaceuticals, Inc. (Manchester, CN) plans to scale up and demonstrate a commercially viable production line employing a novel freeze-drying process to prepare complex biomolecules in powder forms that simplifies the storage and delivery of emerging, protein-based pharmaceuticals.

Ginkgo BioWorks (Boston, MA) plans to develop genetically engineered measurement technologies for real-time monitoring of cellular health and production capacity during the manufacturing of therapeutic proteins.

Isogenis, Inc. (Aurora, CO) plans to develop and optimize standardized manufacturing systems for a novel type of pharmaceutical-grade gene transfer vehicle for vaccination, gene therapy and tissue transplantation applications.

Kent Displays, Inc. (Kent, OH) plans to develop a suite of integrated processes for efficient, "roll-to-roll" manufacturing of flexible, reflective displays for high-volume product markets.

Polyera Corporation (Skokie, IL) plans to develop novel processes for manufacturing organic photovoltaic materials to enable large-scale manufacturing of high-performance, flexible solar-energy modules.

Precision BioSciences, Inc. (Research Triangle Park, NC) plans to create new tools for modifying the chemical structure of proteins that are produced by current biomanufacturing technologies to improve the therapeutic action of the manufactured protein.

Sinmat Inc. (Gainesville, FL) plans to develop the means to fabricate high-quality, super-hard substrates in a rapid, reliable, scalable and cost-effective manner.