

Materials Research in the FY 2014 Budget

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HIGHLIGHTS

The Administration's budget would continue to place physical science R&D on a path of growth in FY 2014 for the National Science Foundation, Department of Energy Office of Science, National Institute of Standards and Technology, and Department of Defense Basic Research. Proposed materials research budgets vary considerably by percent increases in the FY 2014 department and agency budgets. Comparisons are provided in reference to FY 2012 as the baseline:

- ***National Science Foundation*** – Overall 9.4 percent increase for R&D, while the NSF Division of Materials Research (DMR) within the Mathematical and Physical Sciences Directorate would increase by 6.9 percent;
- ***Department of Energy Office of Science*** – Overall 6.3 percent increase for R&D, while Basic Energy Science (BES) would receive a 13.2 percent increase, and Materials Sciences and Engineering (MSE) within BES would receive a proposed increase of 16.9 percent;
- ***Department of Defense*** – Overall 7.7 percent increase for basic research accounts. Defense Advanced Research Projects Agency (DARPA) would increase by 11.3 percent in defense research science programs;
- ***Department of Commerce National Institute of Standards and Technology*** – Scientific and Technical Research and Services would receive an overall 23.2 percent increase.

INTRODUCTION

Materials research is a broad, interdisciplinary field supported by funding from a number of federal departments and agencies. Materials research is conducted in universities, government laboratories, and industry.

Table 1. Materials Science in the FY 2014 Budget
(budget authority in millions of dollars)

	FY 2012 Actual	FY 2014 Budget	Change FY 12-14	
			Amount	Percent
National Science Foundation	5,705	6,240	535	9.4%
Math and Physical Sci*	1,309	1,386	77	5.9%
<i>Materials Research*</i>	294	315	20	6.9%
Department of Energy				
Science	4,463	4,744	281	6.3%
<i>Basic Energy Sci*</i>	1,645	1,862	218	13.2%
Mat Sci and Eng*	346	404	58	16.9%
EERE	1,003	1,715	712	71.0%
ARPA-E	255	345	90	35.3%
Department of Defense				
Basic Research	2,010	2,165	155	7.7%
Applied Research	4,730	4,627	-103	-2.2%
DARPA	2,814	2,865	51	1.8%
<i>Defense Research Sci</i>	283	315	32	11.3%
<i>Materials & Bio</i>	204	167	-37	-18.1%
<i>Electronics Tech</i>	216	243	27	12.5%
Nat'l Institute of Standards and Tech				
Science & Tech Res and Serv	502	618	116	23.2%
National Institutes of Health				
Bio Imaging and Bio Eng	338	339	1	0.3%
National Nanotech Initiative	1,863	1,704	-159	-8.5%

Source: Agency budget justifications and other budget documents.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

*includes non-R&D components

Materials scientists and engineers conduct research that results in fundamental breakthroughs in electronics, energy systems, aerospace, biomedical devices, nanotechnology, transportation, and advanced computation and communication technologies. Materials research supports discovery-class science, state-of-the-art facilities and analytical techniques, as well as programs that advance innovation and provide training for the next generation of materials scientists and engineers.

NATIONAL SCIENCE FOUNDATION (NSF)

Materials research funding at NSF is focused primarily in the Mathematical and Physical Sciences (MPS) Directorate, under the Division of Materials Research (DMR). The MPS Directorate would increase by \$77 million in FY 2014 to \$1.4 billion, an increase of 5.9 percent over FY 2012. Funding for materials research and condensed-matter science would increase by \$21 million in FY 2014 to \$315 million, an increase of 6.9 percent over FY 2012. The proposed percent increase is proportionally less than the overall NSF R&D budget increase of 9.4 percent.

NSF has identified Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS) as their highest priority investment for FY 2014. The CEMMSS program FY 2014 proposed budget is \$300 million, up 112 percent from \$142 million in FY 2012. Through CEMMSS, NSF participates in the Administration's Materials Genome Initiative (MGI).

There are also programs within MPS, like the Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21), which would enhance computational capabilities that impact these same programs. The FY 2014 proposed budget for CIF21 is \$155 million, an increase of 99 percent from \$78 million in FY 2012.

DMR's FY 2014 request includes focus areas in which advanced materials are key, including the Sustainable Chemistry, Engineering, and Materials (SusChEM) effort under the NSF-wide Science, Engineering, and Education for Sustainability (SEES) program area.

Materials Centers in the FY 2014 proposed budget for DMR would increase by \$11.7 million to a total of \$56 million. The Materials Centers are interdisciplinary vehicles for increasing materials research and educating students.

DEPARTMENT OF ENERGY (DOE)

DOE supports fundamental and applied materials research that seeks to achieve transformative discoveries in a wide range of global energy and national security challenges. The DOE budget emphasizes the importance and priority of materials, chemistry, and biology by design.

The Office of Science (SC) is the largest federal sponsor of basic research

in the physical sciences. In FY 2014, funding for Materials Science and Engineering (MSE) would rise to \$404 million, an increase of 16.9 percent over FY 2012. This two-year increase is very significant, as Basic Energy Sciences (BES) is projected to grow 13.2 percent within an overall SC budget limited to 6.3 percent growth for R&D over FY 2012. BES is the largest of the program areas within the Office of Science, due mainly to stewardship of national user facilities. Within non-facility-based research programs of BES, the MSE Division includes materials discovery, design, and synthesis; condensed matter and materials physics; and scattering and instrumentation sciences.

The Department of Energy oversees seventeen national laboratories through SC and the National Nuclear Security Administration (NNSA). The Basic Energy Sciences (BES) program operates the Scientific User Facilities (SUF) Division, with large national user research facilities, including synchrotron and neutron sources, nanoscience centers, and smaller user facilities for materials preparation and electron microscopy. The FY 2014 budget would provide funding for these facilities with benefits to materials research at a level of \$990.2 million, an increase of 18 percent over FY 2012. BES operates five Nanoscale Science Research Centers within SUF at national laboratories and, through their user programs, supports a wide range of individual programs on nanoscience.

BES manages the Energy Frontier Research Centers (EFRCs), which are multi-investigator and multidisciplinary centers that pursue projects of high priority to energy research. The scientific directions for these centers cut across materials science and engineering, chemical sciences, geosciences, and biosciences. In FY 2014, the EFRC materials science program would continue and receive \$98 million in funding, a 71 percent increase over FY 2012, to both support the existing centers and establish new ones throughout the United States.

DOE supports applied materials research for energy technologies through a number of programs in Energy Efficiency and Renewable Energy (EERE), and directed materials research for national security through the NNSA's Weapons Activities, within the Science and Engineering programs. The newly renamed Advanced Manufacturing Office in EERE would focus on materials technologies and production techniques that have broad applications for energy-intensive manufacturing methods. The Advanced Research Projects Agency-Energy (ARPA-E) is a source of funding for

high-risk, high-payoff materials research projects. In addition, DOE has continued to manage Energy Innovation Hubs including the new Critical Materials Hub at Ames Laboratory.

DEPARTMENT OF DEFENSE (DOD)

DOD funds materials research through the Army, Navy, and Air Force research organizations, and through defense-wide agencies that support the entire department such as the Defense Advanced Research Projects Agency (DARPA).

Basic research (“6.1”) in the military classification system for all DOD agencies (see Chapter 5 for an explanation) would increase in FY 2014 by 7.7 percent to \$2.2 billion compared to FY 2012. The applied research category (“6.2”) would decrease by 2.2 percent to \$4.6 billion.

Materials science and technology programs vary considerably depending on the individual defense agency. Navy basic research would increase by 4.2% in FY 2014 when compared to FY 2012. The Army and Air Force basic research accounts would increase by more than 6 percent. DARPA funding for Defense Research Sciences (“6.1”) would increase by 11.3 percent to \$315 million in FY 2014. Applied research within DARPA Materials and Biological Technology would decrease by 18.1 percent to \$167 million, and within Electronics Technology would increase by 12.5 percent to \$243 million. These DARPA program categories are the principal funding sources for materials research in the agency. In addition, programs in the Microelectronics Technology Directorate also support the materials science community. Initiatives in heterogeneous electronics, engineering biology, information technology, and big data are all examples in the current budget request where materials research continues to play an important role in advancing new technologies.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST’s Scientific and Technical Research and Services R&D budget is proposed to increase by \$116 million to \$618 million, which is 23.2 percent above FY 2012 funding. NIST develops measurements, standards, and data needed to advance the development of metals, ceramics, polymers, nanomaterials, biomaterials, and electronics and semiconductor materials that are critical to national needs related to commerce. The

budget emphasizes manufacturing technologies, network infrastructure, and support for the MGI program and data standards.

OTHER AGENCIES

Three other agencies also provide support for materials science: the National Aeronautics and Space Administration (NASA), the National Institutes of Health (NIH), and the Department of Homeland Security (DHS). These agencies do not separately report materials science budget line items. Both NASA Science and Aeronautics budgets have programs which support materials research. Within NIH, the National Institute of Biomedical Imaging and Bioengineering (NIBIB) is an important funding agency for materials research with an emphasis on health-related science and applications. At DHS, the Science and Technology Directorate conducts applied research on programs that impact materials science. The overall agency budgets for federal R&D are analyzed in their respective chapters.

NATIONAL NANOTECHNOLOGY INITIATIVE (NNI)

The federal government investment in the cross-cutting National Nanotechnology Initiative (NNI) would decrease by 8.6 percent compared to FY 2012 to \$1,704.0 million. NNI agencies focus on research in materials, devices, and systems that exploit the unique physical, chemical, and biological properties that emerge in materials at the nanoscale. NNI programs by agency and specific signature initiatives are outlined in Chapter 23.