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Funding the future of materials science

NSF issues awards for new Materials Science and Engineering Centers



The MRSEC program creates hubs of broad collaboration across diverse research interests.

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The National Science Foundation (NSF) has issued eight new 2017 Materials Research Science and Engineering Center (MRSEC) awards that will drive cutting-edge science and engineering.

Totaling \$145 million, these six-year grants will support innovative work in materials science and help train the next generation of materials researchers.

"These awards are representative of the incredibly broad, highly multidisciplinary research portfolio spanning all Division of Materials Research priority areas," said Linda Sapochak, director of the NSF Division of Materials Research (DMR). "These centers will forge new research frontiers through team-based development of novel materials that are relevant to future high-tech applications."

The centers address a national priority: fostering collaboration among universities, national laboratories, industry and international scientific organizations in order to address complex fundamental research challenges. Such challenges include extreme miniaturization, atomically thin "paper" materials that self-fold

into functional structures, and control over the assembly and reconfiguration of nanoparticles connected at the molecular scale.

NSF launched the MRSEC program in 1994, as a successor to the federal government's Interdisciplinary Laboratories and Materials Research Laboratories programs. Like other NSF-funded centers, MRSECs serve as hubs of broad collaboration across diverse research interests, simultaneously addressing several complex scientific questions while driving diverse education and outreach efforts.

The MRSEC awards will have far-reaching impact on fields ranging from telecommunications and clean energy, to quantum information sciences.

"Research outcomes from these awards could revolutionize computer memory and wearable medical devices," said Sean L. Jones, DMR's deputy division director.

With the 2017 awards, there are currently 20 MRSECs across the country that involve more than 2,200 individuals, from faculty and postdoctoral researchers to graduate and undergraduate students and skilled technicians.

"The MRSEC centers provide leadership for the country concerning new materials and new materials phenomena addressing national needs, including sustainability and innovation," Sapochak said. "We are especially excited about the international, industrial and national laboratories' collaborations that will give junior researchers in the centers experiences valuable to their lives as scientists and engineers, and the incredibly diverse and highly skilled personnel participation."

Of the eight awards, three are for new centers: the University of Texas at Austin, the University of Illinois Urbana-Champaign, and the University of Washington. The other five awards support centers that have stood out for successful, ongoing, collaborative research.

The 2017 MRSEC awards are listed below.

New center awards

[Center for Dynamics and Control of Materials <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720595>](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720595), University of Texas at Austin

This center seeks to extend the traditional paradigm of materials research beyond the study of behavior in or near equilibrium to encompass the understanding and control of materials over extended temporal and spatial scales. It supports research on nanocomposite materials that combine inorganic and organic components, with applications in energy storage, filtration membranes and approaches for exploiting light to achieve dynamic, quantum control of materials.

[Illinois Materials Research Center <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720633>](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720633), University of Illinois Urbana-Champaign

This center will focus on performing fundamental, innovative research broadly centered on understanding the dynamic properties of materials, supporting interdisciplinary education and the training of students in materials design, understanding and application. Research at the center will form the basis for new technologies in electronics, information storage, photonics and biomaterials that will greatly benefit society.

[UW Molecular Engineering Materials Center <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1719797>](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1719797), University of Washington

This new MRSEC will forge new materials-research frontiers through team-based development of novel electronic and photonic materials relevant to future high-tech applications. With a focus that encompasses new innovations in synthesis, theory and application, the MRSEC will integrate students, faculty, facilities and research. The center will emphasize aggressive diversification in science, technology, engineering and mathematics (STEM) and community involvement through two signature programs: promotion of veterans in STEM career tracks, and early recruitment and mentorship of students from regional high schools underserved in STEM.

Awards to existing centers

Materials Research Science and Engineering Center at UCSB

<https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720256>, University of California, Santa Barbara

This MRSEC develops and sustains the necessary workforce and physical infrastructure to advance research, education and training in materials science in an integrative manner. Its research integrates the preparation of new materials with the development of breakthrough theories to understand them and advanced tools to measure their properties. Developing job creation through start-ups and workforce preparedness through award-winning education and outreach is a goal that threads through all of the center's activities. The MRSEC's three interdisciplinary research groups' work encompasses hard magnetic intermetallic materials and their microstructure, the chemistry and engineering of an underexplored class of polymeric materials, and biomaterials and bioinspired processing.

Cornell Center for Materials Research <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1719875>, Cornell University

This center focuses on problems that require the combined expertise of interdisciplinary teams of Cornell researchers and external collaborators. Its research focus ranges from discovering, understanding and applying new mechanisms for controlling spins in magnetic devices, to understanding, creating and harnessing exceptionally strong light-matter interactions. The center is developing the underlying science needed for applications that could include next-generation computer memories, the development information processing capabilities using light, and a new class of self-folding devices based on atomically-thin, paper-like materials.

Center for Multifunctional Materials <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720139>, Northwestern University

This MRSEC explores how nanoelectronic materials systems that simultaneously process and store information compare to complex biological systems, such as neural networks. Its research brings together experts in materials synthesis, computational design of materials, and advanced structural measurement to expand a relatively unexplored class of materials with unconventional combinations of electrical and thermal properties.

Materials Research Science and Engineering Center <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720530>, University of Pennsylvania

The MRSEC's research from 2017-2023 will focus on creating advanced materials with unique properties and applications. Three distinct interdisciplinary research groups work to develop ways to make glasses less fragile, produce fiber networks that chemically reconfigure in response to stress, and explore new ways to combine and utilize nanocrystals and liquid crystals. Recurrent themes are networks, interfaces, assembly, design rules, collective interactions, with the goal of creating advanced materials with unique properties and applications.

Wisconsin Materials Research Science and Engineering Center

<https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720415>, University of Wisconsin–Madison

This center brings together teams of interdisciplinary researchers -- undergraduates, graduate students, postdoctoral fellows and faculty -- to understand, at the atomic and molecular levels, how to create new materials that will enable next-generation technologies. The research has far-reaching impact on fields ranging from telecommunications, clean energy and quantum information sciences. The MRSEC's research goals are to design, synthesize and understand disorder and the emergence of order across a wide range of materials platforms. The research is organized into two interdisciplinary research groups addressing complex challenges involving metals, inorganic oxides, semiconductors and complex organic molecular assemblies.

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