

Center for Micro-Engineered Materials

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2017 Annual Review Of Category 3 Research Centers/Institutes | March 9, 2018

Mission

The primary mission of the UNM Center for Micro-Engineered Materials (CMEM) is to serve as the focal point for collaborative, interdisciplinary nanomaterials research and education on the UNM campus, to develop new, interdisciplinary technologies to make the United States more competitive in engineering nanoscience, and to transfer these technologies to industry to foster the development of competitive, reproducible nanomaterials for advanced, high performance systems.

2017 Goals And Status

- Supporting internationally prominent research in materials science;
- Building externally funded collaborative research programs;
- Creating a collaborative environment and opportunities for National Laboratory scientists to work with UNM faculty;
- Creating opportunities for broadly engaging industrial collaborations;
- Engage and lead in materials science research initiatives with other NM universities (this has not materialized as of yet);
- Ongoing service center mission based on the characterization facilities (there are still outstanding issues with service centers management and operation in EPS).

Membership of Advisory Committee

Reporting to **Gabriel Lopez**, UNM Vice-President for Research
Advisory Committee (all ex-officio):

Christos Christodoulou, Dean of Engineering and Computing

Mark Peceny, Dean of Arts and Sciences

Sang M. Han, Associate Chair of Chemical and Biological Engineering

Jeff Rack, Chair of Chemistry and Chemical Biology

Yu-Lin Shen, Chair of Mechanical Engineering*

Arash Mafi, Director of UNM Center for High Technology Materials*

Elizabeth Kuuttila, President and CEO of STC.UNM

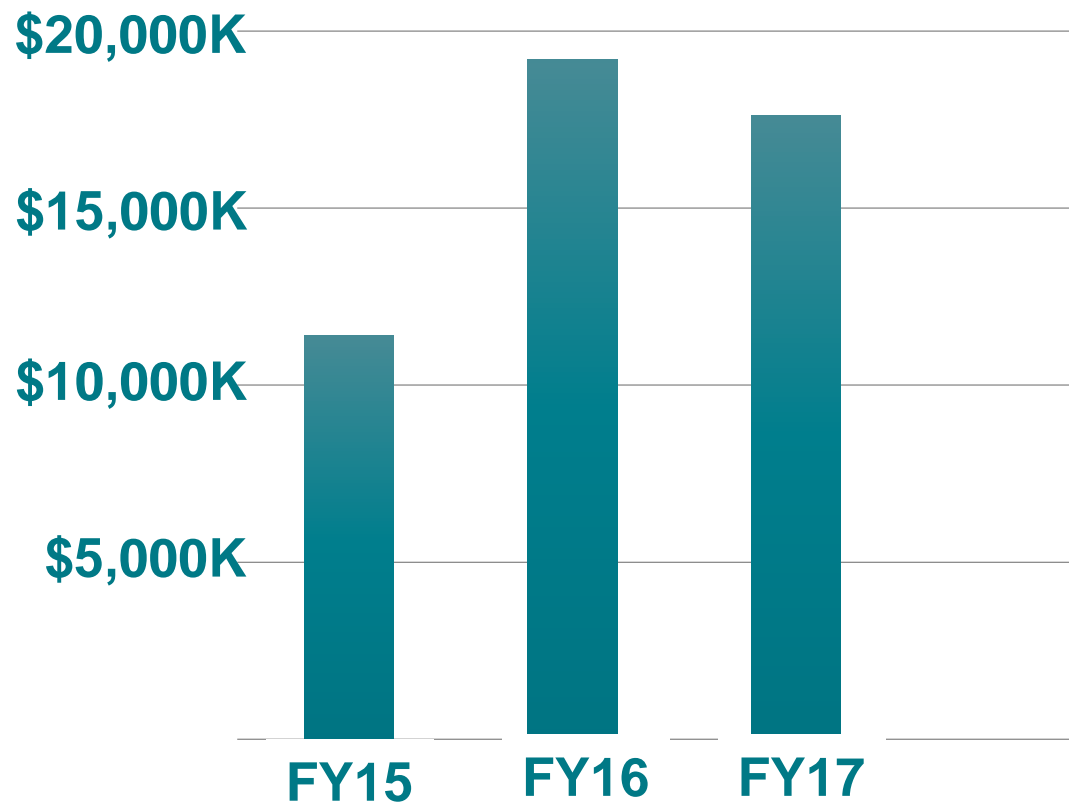
*Courtesy invitation

2017 Highlights

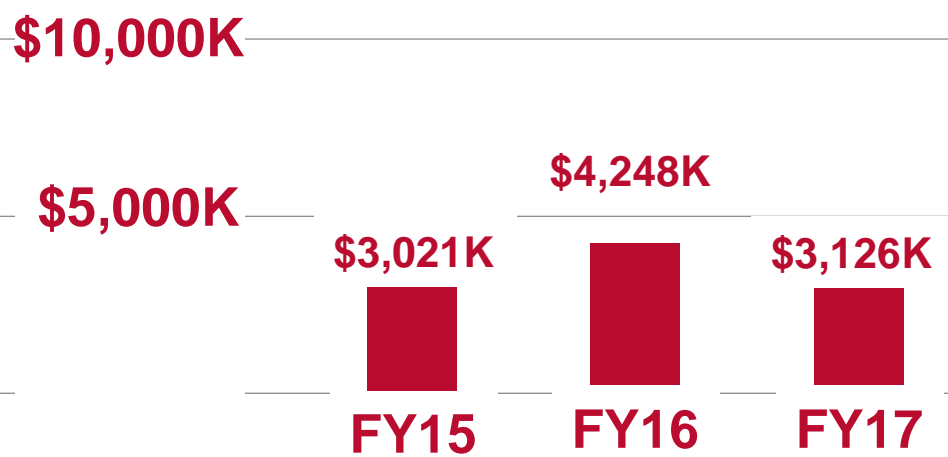
- **CISTAR: Center for Innovative and Strategic Transformation of Alkene Resources (NSF-ERC)** was awarded to a consortium lead by Purdue University with major participation of three CMEM faculty: Professors **A. Datye**, **C.J. Brinker** and **F. Garzon**. <https://cistar.us>
- Major national awards of distinction include DOE 2017 R&D 100 Award to UNM/Sandia National Laboratory team lead by **Prof. F. Garzon** “SolidSense” development of advanced sensor arrays for emissions control.
- Prof. **P. Atanassov** was elected Fellow of the Electrochemical Society. He completed his term as a vice-president of the International Society of Electrochemistry. P. Atanassov was the co-chair of the ISE annual meeting in Providence, RI. With 1600 participants from 30+ countries this was one of the largest professional events in electrochemistry community for the year. P. Atanassov was inducted in the National Academy of Inventors.
- Prof. **C.J. Brinker** was awarded the Life Time Achievement Award in Sol-Gel Science and Technology by the International Sol-Gel Society during the 19th International Sol-Gel Conference, Liege, Belgium. He completed his term as Materials Research Society Board of Directors.
- Prof. **A. Datye** was the co-chair of the North American Catalysis Society annual meeting, Denver, CO. This is the premier meeting for the heterogeneous catalysis community, with over 1500 attendees representing industry, national lab and academia, and significant international participation. He was elected member-at-large of the Board of Directors of NAM.
- Eleven graduate students and postdocs won best poster awards at some 6 different conferences.

Proposals & Awards

PROPOSALS

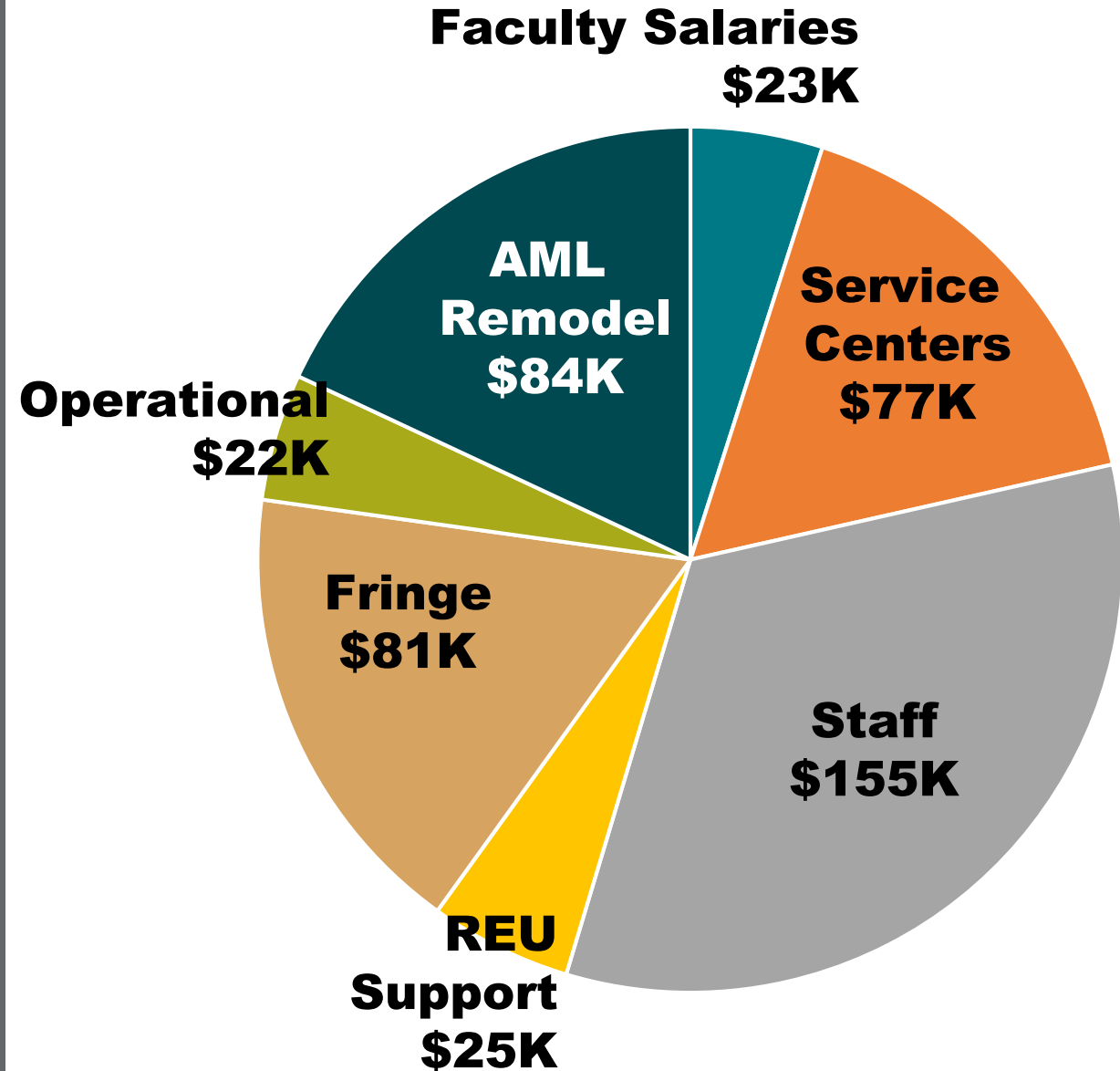


AWARDS



FY 2017 Budget

FY17 Adopted Budget	\$615K
FY17 Actuals Revenue	\$462.6K
• FY16 Carryforward	\$105.9K
• OVPR Allocations	\$200K
• F&A Return	\$339K
• SAC	\$30K
• OVPR pullback	- \$16.7K
• C/Share	- \$13.8K
• Classroom/Equipment	- \$17.5K
• Start Up Dr. Carroll	- \$125K
• PI F&A Return	- \$39.3K
FY17 Actuals Expenses	\$467.6K
FY17 Carry Forward	\$5.0K



Research Center Impacts

- CMEM provides access to major materials characterization instruments (TEM, SEM, FIB, XRD, XPS, XRD, etc.) through 6 user facilities/cost centers. For all of these tools CMEM provides training to students and faculty researchers and for most of them accompanies that with an option of research specialist support.
- Major research outreach activities are in partnership with STC.UNM and Rainforest Economic Development Forum. CMEM faculty engage also in education in community outreach through their programs.
- CMEM faculty (including a number of research faculty) teach courses in CBE, NSME and CCB academic programs
- Substantial fraction of CMEM research (up to 45% by the funding source) is in applied science and results in multiple collaborations with DOE national laboratories and industry. Currently CMEM is engaged in technology transfer to 3 NM startup companies and 3 large/multinational corporations.
- CMEM user facilities are a resource for the state and the region having sustained users in local research community including LANL and SNL.

Return On Investment

- Training & Pipeline: 5 postdoctoral researchers; 48 graduate students (39 PhD students) and 23 UNM undergraduate and 19 REU and other visiting students
- During 2017 CMEM researchers published 53 peer-reviewed articles in journals including *Science*, *Nature Comm.*, *Angewandte Chemie*, etc.
- The number of research awards was 37, with total of \$3,126,124
- Total number of U.S. patents filed was 29 and CMEM inventors were granted 15 issued US and international patents. There are 6 active options/license agreements through STC.UNM on CMEM-generated IP.
- Industry engagement include partnering with large companies (Nissan) and specialized manufacturers (Proton-OnSite) on DOE-funded programs, as well as startup activities in NM such as Pajarito Powder LLC, Automotive Test Solutions LLC and Angstrom Thin Film Technologies LLC,

CMEM research portfolio in areas of catalysis and electrocatalysis for energy conversion and storage, designer materials for sensing and separations and nanomaterials for biomedical/clinical applications are well established. CMEM senior faculty are national leaders in their respective technical areas with highest levels international professional recognition.

STRENGTHS

CMEM lacks ability to recruit new talent and junior faculty. As a result it is “top heavy” with no path to independent development or strategy. To compensate, it supports high number of research faculty that affects its financial structure.

WEAKNESSES

CISTAR (NSF-ERC) creates a new opportunity to diversify the research portfolio both in terms of funding source and research themes. This can be augmented in new initiatives and collaborations such as NSF-CCI and other similar multi-investigator opportunities, like DOD-MURI.

OPPORTUNITIES

Over-dependence on DOE-EERE programs is the largest single threat to CMEM financial health. Overextending the reserves to cover for the AML remodeling coincided with a year of lowered revenues of the cost centers and create a threat to ability to support service contracts.

THREATS

Looking Ahead To 2018

- Building programs in materials and interfaces for synthesis and conversion of hydrogen and non-carbon fuels (ammonia): understanding of reactions of hydrogenation and dehydrogenation at the interface and the role of the materials “skin”; bio-inspired inorganic materials design and synthesis. The fundamental components of this is to be pursued through NSF and DOE-BES, with potential for ARPA-E and DOE-EERE targets.
- Materials for advanced manufacturing: development of materials base, processing and technology platforms for 3D printing of functional nano-materials (including biomaterials and living cells) with feature controls at meso-scale and scale-up to macro-scale films and devices. This includes close coordination with SNL-AML and coordination with SOE. Aiming to build towards a successful DOE-EERE AMP and NSF programs.
- Industrial affiliates program in advanced materials: building a broad partnership for collaborative pre-competitive research. Targeting NSF-I/UCRC and potential NSF-ERC affiliates programs

Summary

- CMEM completed the relocation of its major activities to AML and practically turned the “west wing” into a self-sufficient operation: a cutting edge materials research site with unique synthesis, scale-up and materials integration capabilities supported by state-of-the-art characterization instruments, operated as user facility to benefit UNM, ABQ and NM community, and with a national network of users/sponsors.
- CMEM has strong national presence with multi-investigator participation in NSF, DOE and DOD programs, and international visibility through the professional service and visibility of its faculty and organization of major learned society events.
- CMEM at AML is a vibrant site at UNM Science & Technology Park, and is aiming to continue being a “human bridge” to SNL supporting collaborations in materials research.
- CMEM would like to find a path, working with OVPR, to attract, recruit and co-fund junior and mid-career faculty members from/with A&S and Engineering to form an intellectual backbone (along with CHTM) of UNM materials science & engineering community, and have a strong “anchor” with both SNL and LANL, hopefully through new joint appointments.