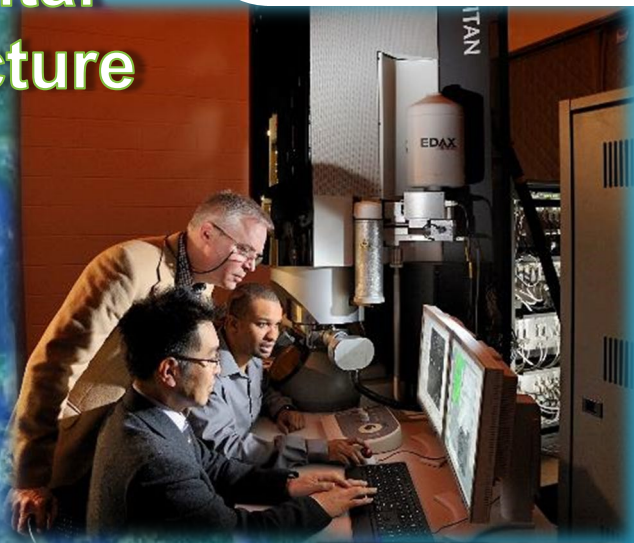
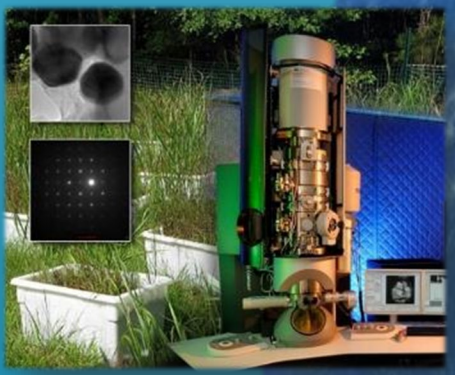
The Virginia Tech National Center for Earth and Environmental Nanotechnology Infrastructure

NanoEarth





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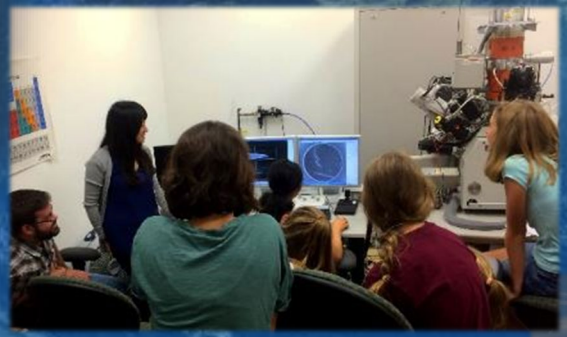

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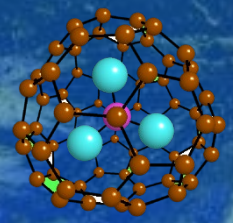

VT | INSTITUTE FOR CRITICAL TECHNOLOGY AND APPLIED SCIENCE VIRGINIA TECH.

Pacific Northwest NATIONAL LABORATORY

Site Overview: NanoEarth at Virginia Tech

- NanoEarth is the only NNCI site dedicated to the nanoscience and technology of Earth and its environment.

Partner:

Pacific Northwest NATIONAL LABORATORY

EMSL

- Focus Areas:
  - Non-traditional areas of study
  - Diversity – MUNI (Multicultural & Underrepresented Nanoscience Initiative)
  - Innovation & Entrepreneurship

NTEC winning team makes it to the finals of the Virginia Tech Entrepreneurship Challenge.

MUNI visitors from Hampton University synthesize nanoparticles in the VTSuN Lab.

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NanoEarth User Data

Yearly User Data Comparison			
	Year 1	**Year 2**	**Year 3 (6 months)**
Total Users	280	307	221
Internal Users	232	245	184
External Users	48 (17%)*	62 (20%)*	37 (17%)*
External Academic	22	25	15
External Industry	25	27	19
External Government	0	5	3
External Foreign	1	5	0
Total Hours	7,627	18,056	8,511
Internal Hours	6,196	14,277	7,091
External Hours	1,431 (19%)	3,779 (21%)	1,420 (17%)
Average Monthly Users	79	76	98
Average Ext. Monthly Users	9 (11%)	14 (18%)	13 (13%)
New Users Trained	232	107	47
New External Users Trained	0 (0%)*	0 (0%)*	0 (0%)*

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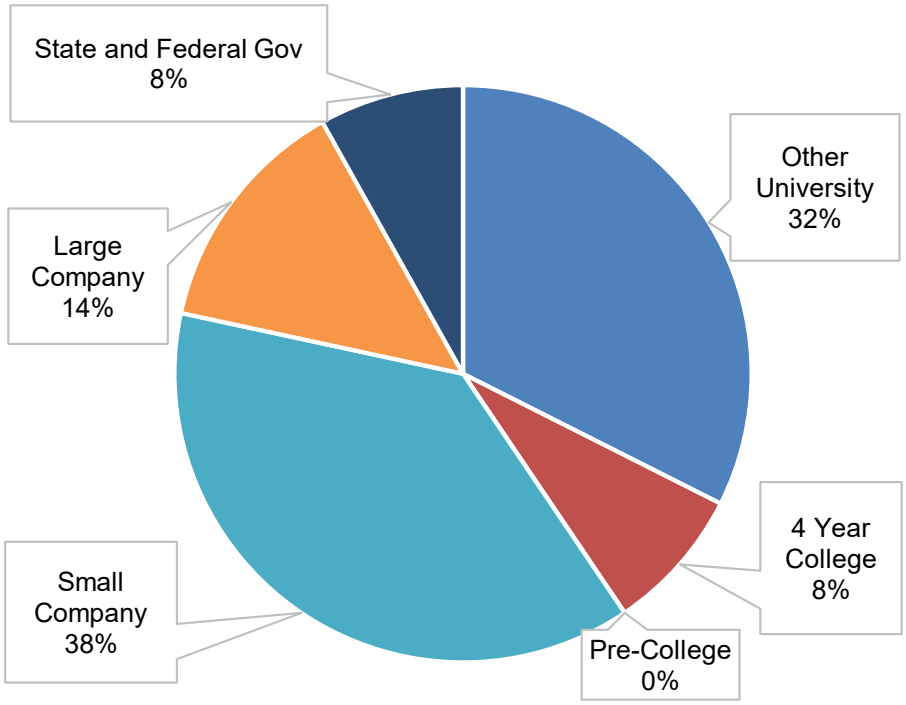
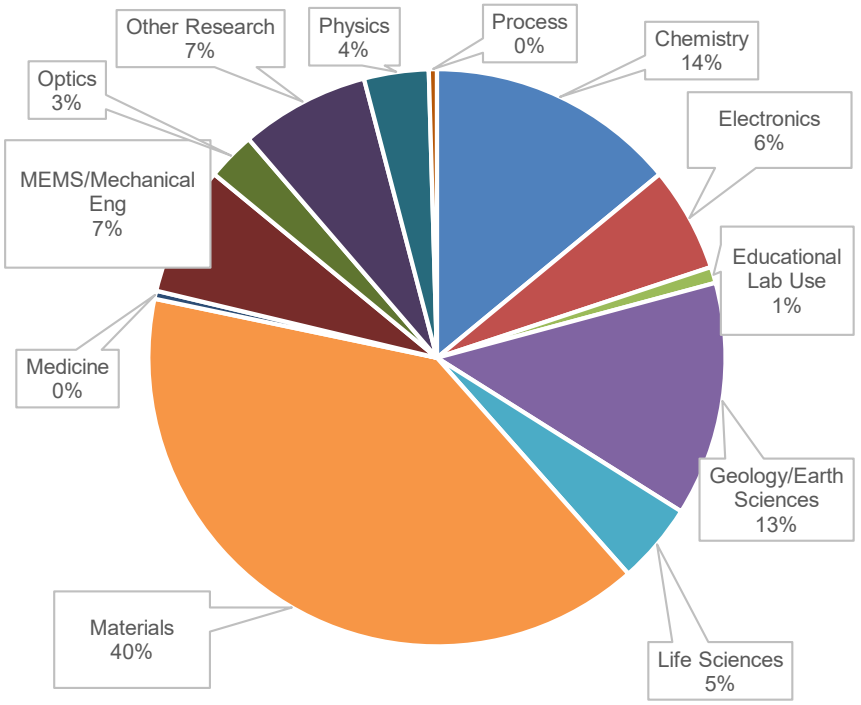
* NNCI funds predominately support external users. External users are not trained and instead NanoEarth staff operate instrumentation on their behalf.

NanoEarth User Data

External User Affiliations



All User Disciplines



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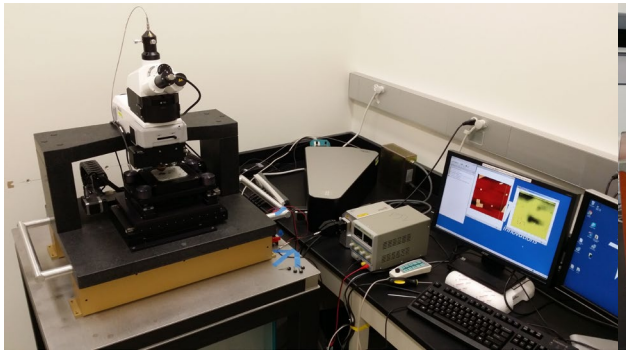
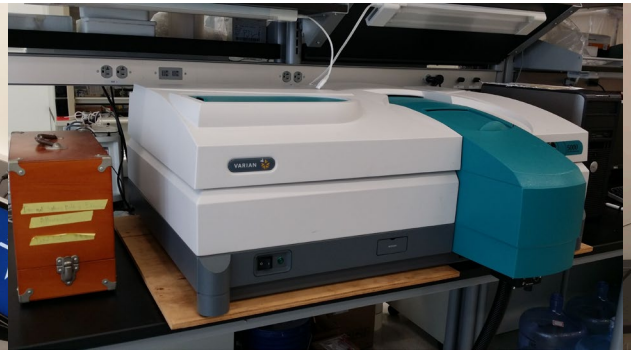
Important NanoEarth Considerations & Statistics

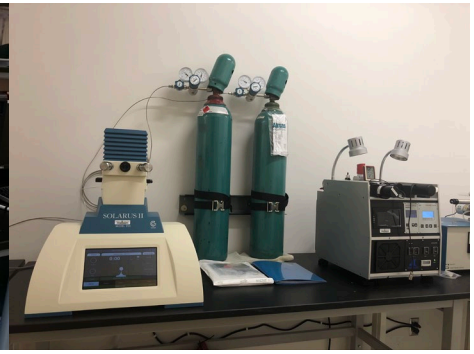
- As the research area options are limited, environmental researchers must classify themselves in another area.
  - While the hope is for researchers to select "Geology/Earth Science", many choose based on the research methodology employed (e.g. materials, chemistry)
  - "Other Research" is also common, but can be viewed as a negative choice
- NNCI funds predominately support external users. Internal users benefit indirectly from the presence of an NNCI node.
- External users are not trained and instead NanoEarth staff operate instrumentation on their behalf.

Facility Upgrades and New Tool Capabilities

- **Cary 5000 UV-vis-NIR** – higher absorbance detection limits, samples can be measured directly without dilution in the whole range of UV to near infrared
- **WITec Raman Microscope Laser Replacement** – increased laser power allows weak Raman bands (like breathing modes of carbon nano materials) to be detected, can generate Raman signals inside samples
- **Specialized TEM Specimen Holder Vacuum Station, Argon Ion Milling System, & 3-gas Plasma Cleaner** – for preparing TEM samples with greatly reduced organic contamination







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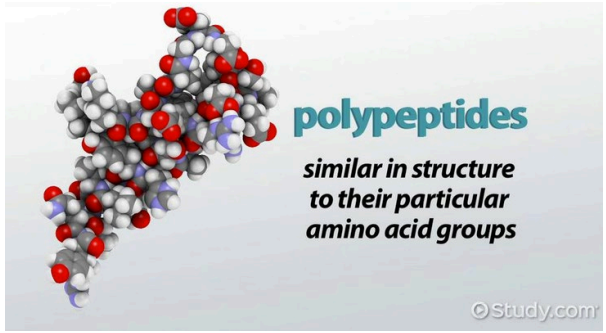
Research Highlight – EMSL-PNNL

Preservation of endogenous biomolecules in the fossil record.

PhD candidate Caitlin Colleary, Virginia Tech

- Hypothesis: The proteins detected in dinosaur fossils can be definitively assigned to the original organism and excluded from exogenous contaminants.



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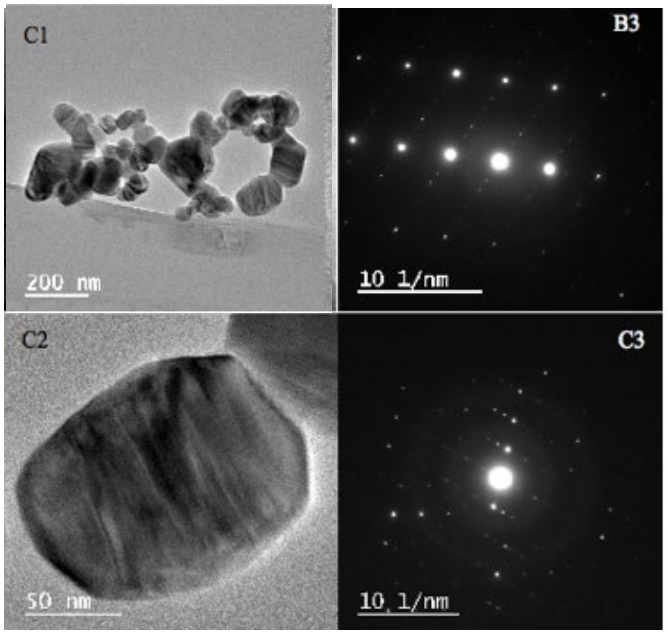
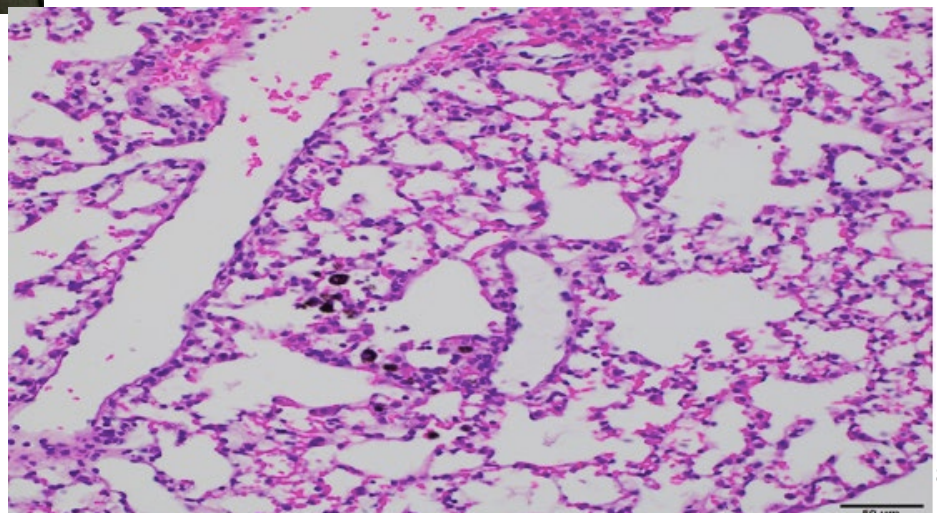
Research Highlight

Yang, Y. et al. (2017) *Nature Communications*, v. 8, p. 194; doi:10.1038/s41467-017-00276-2

- Titanium suboxide, Magnéli phases (Ti_xO_{2x-1}), produced during coal burning



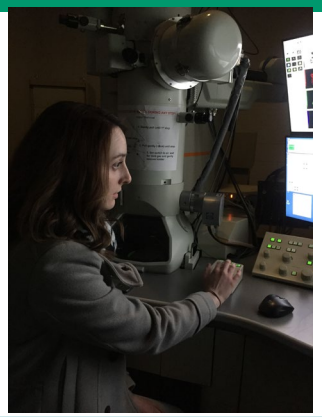
A coal ash impoundment in China



Impact of Education & Outreach Activities

NanoEarth Education & Outreach Events Year 3	
	# Participants
Industry & Entrepreneurship Events (10)	319
Seminar & Brown Bag Series (11)	162
Conference Events (3) SNO, SERMACS, ACS	20,300*
Workshop/Group Hosting (6) City University of New York, Tochiku High School – Japan, Fayetteville State University, Ferrum College, VT College of Engineering Open House, Nanoscience Professional Development Workshop	60
Library Collaboration Events (2)	50
HBCU/MSI Research Summit	10
Virginia Tech Science Festival	5,000*
USA Science & Engineering Festival	370,000*
Pentagon to the People at Fayetteville State University	12
NSF Science Workshop	15
Nanoscience Teacher Training	6
Governor's School for Agriculture	20
REU: KAUST & Macedonia	3
NanoCamp	40
Goldschmidt2018 Workshop	40
Pulse of the Planet	270,000

*Entire event attendance



City University of New York & Kingsborough Community College Visit					
N = 10	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The visit presented technical information (research, science, etc.) that is exciting and interesting to me.	100%	/	/	/	/
I have a greater understanding about nanotechnology after my visit.	90%	10%	/	/	/
I had good interactions with students, faculty, and staff during my visit.	90%	10%	/	/	/
After this visit, it is likely that I will, or hope to, engage further with NanoEarth & Virginia Tech in the future (more visits, apply to attend, etc.)	80%	20%	/	/	/
Overall, I had an enjoyable and educational visit at NanoEarth and Virginia Tech.	100%	/	/	/	/

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NNCI Cooperative Network Activities

Network-Wide

- Participation in 8 subcommittees and working groups, resulting in shared reports and best practices
- Attendance at NNCI annual conference
- Participation in Nano Day activities

Multi-Site

- Conference exhibit booths: SERMACS with SENIC and RTNN
- Workshop organization: Goldschmidt 2017 & 2018 workshops with MONT
- User project support and staff technical interactions

On Behalf of the Network

- Pulse of the Planet
- Coordination with Japan's Nanotechnology Platform, partner national network of NNCI

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Panel Session: Workforce Development

- High School Teacher Training
- Community Colleges
  - Tailored workshops for groups of community college students
- Undergraduates
  - Professional development workshop on career opportunities
  - HBCU/MSI Research Summit
  - NanoTechnology Entrepreneurship Challenge
  - REU-esque experiences
- Graduate Students
  - Goldschmidt2018 Workshop
  - Industry Speaker Series
- Staff Retention
  - Encouraged to continue professional development
    - Technical development support
    - Attending meetings of professional societies

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Acknowledgements

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