

# CINT

SAND2017-1458PE

The Center for Integrated Nanotechnologies

*Nanomaterials*

*Integration*

*A U.S. DOE Nanoscale Science Research Center*

## CINT: A National User Facility for Nanoscience Research (Free Science!)

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000



# CINT is a DOE Office of Science National User Facility

“A DOE/SC user facility has **unique world-class research capabilities and technologies** which are **available broadly to science community** worldwide from universities, industry, private laboratories, and other Federal laboratories for work that will be **published in the open literature.**”



## The DOE/SC nanoscience centers:

- Are defined by a scientific field, not specific instrumentation.
- NSRC staff support user projects and conduct original research.
- Capabilities involve expertise, hardware and software.
- Users access Synthesis, Fabrication, Characterization and Theory capabilities.



# CINT is a LANL/SNL partnership to create a National resource for nanomaterials integration

## CINT History:

- 2001 DOE approves CINT proposal
- 2002 Sandia / Los Alamos MOU
- 2003 Jump-start operations
- 2004 Ground breaking
- 2006 Buildings dedicated
- 2007 Full operations

## CINT Today:

- 4 Science Thrusts, 1 leadership team
- 2 Facilities (total 130,000 gsf)
- 51 scientists & technologists
- 32+ post-docs & students
- 500+ users engaged in 200+ projects
- 270+ publications annually
- Peer-reviewed user proposal process
- No-fee for pre-competitive research
- Full cost recovery for proprietary research

## Core Facility



## Gateway Facility





# Differentiator : Nano-Integration

## Nano-integration can take many forms

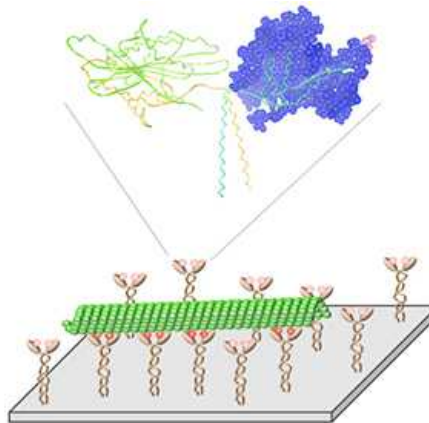
### Mechanical strengthening from incorporation of nanotubes



Carbon nanotubes in 17<sup>th</sup>  
Century Damascus steel

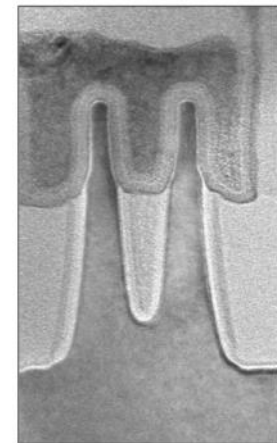
Reibold, et. al, Nature 444, 286  
(2006)

### Collective behavior of biological systems



kinesin nanomotors to  
transport microtubules  
and nanoparticle payloads

### Nano-scale patterning to build hierarchical structures



Intel 14nm  
Broadwell CPU  
(2015) ~100 Atoms

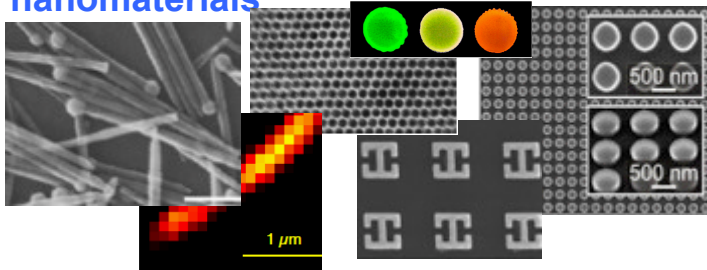




# CINT has four scientific thrusts that steward capabilities

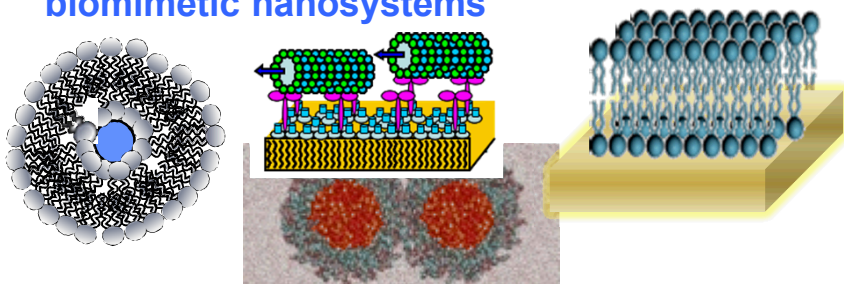
## Nanophotonics & Optical Nanomaterials (NPON)

Synthesis, excitation and energy transformations of optically active nanomaterials



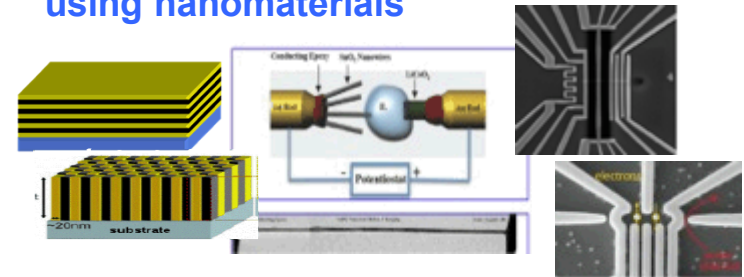
## Soft, Biological, & Composite Nanomaterials (SBCN)

Solution-based nanomaterials synthesis and assembly of soft, composite and artificial biomimetic nanosystems



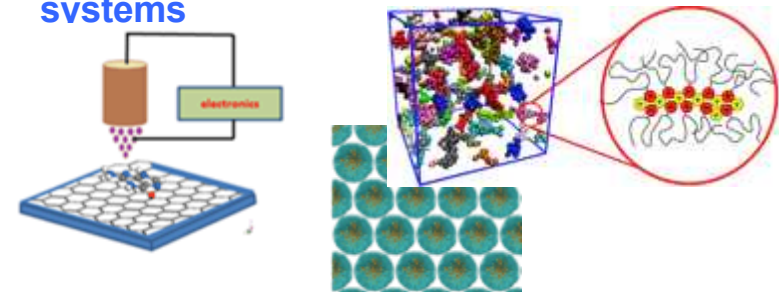
## Nanoscale Electronics & Mechanics (NEM)

Control of electronic transport, wavefunction, and mechanical coupling using nanomaterials



## Theory & Simulation of Nanoscale Phenomena (TSNP)

Assembly, interfacial interactions, and emergent properties of nanoscale systems





# CINT has capabilities for synthesis, characterization and integration

## Characterization Wing

- TEM, SEM
- Low Temp Transport
- Scanning Probe Microscopy
- Ultra-fast Laser Spectroscopy

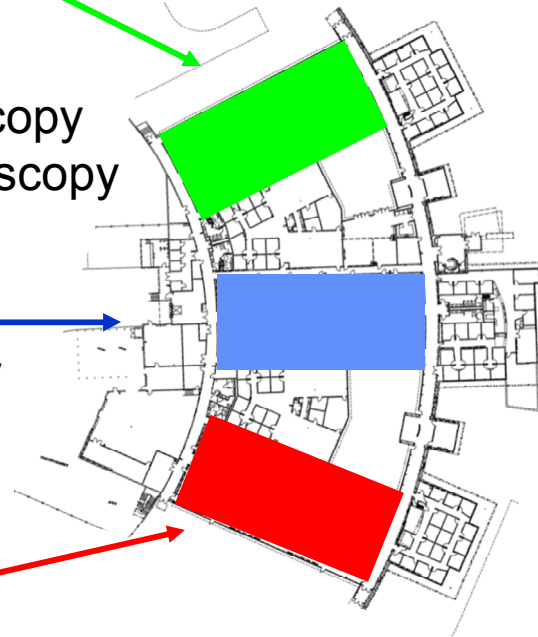
## Synthesis Wing

- Molecular Beam Epitaxy
- Chem & Bio labs
- Molecular films

## Integration Lab

- E-beam lithography
- Photolithography
- Deposition & Etch
- SEM/FIB

## Core Facility



## Gateway to Los Alamos

- NSOM, AFM
- Environmental SEM
- Nano-indenter
- Pulsed Laser Dep.
- Ultra-fast Spectroscopy
- Computer Cluster
- Visualization Lab

