Nanomaterials and Technologies for Naval Applications

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Summary

- Wide range of defense applications for nanomaterials
- Established mechanisms for collaboration
  - SBIR / STTR (ONR, NAVSEA, others)
  - Mantech
  - Other ONR-sponsored mechanisms
  - NSRP
  - Relevant conferences
Connecting

- SBIR / STTR
  - http://www.navysbir.com/
  - https://www.fbo.gov/

- Navy Manufacturing Technology (Mantech)
  - Centers of Excellence
    - Benchmarking and Best Practices Center of Excellence (B2PCOE)
    - Center for Naval Shipbuilding Technology (CNST)
    - Composites Manufacturing Technology Centers (CMTC)
    - Electro-Optics Center (EOC)
    - Electronics Manufacturing Productivity Facility (EMPF)
    - Energetics Manufacturing Technology Center (EMTC)
    - Institute for Manufacturing and Sustainment Technologies (iMAST)
    - Navy Joining Center (NJC)
    - Navy Metalworking Center (NMC)
  - https://www.dodmantech.com/
Connecting

- **ONR**: http://www.onr.navy.mil/
  - Office of Innovation
  - Office of Research
  - Office of Transition

- **National Shipbuilding Research Program**
  http://www.nsrp.org/

- **Opportunities at conferences**
  - Naval S&T Partnership Conference
  - SBIR  http://www.acq.osd.mil/osbp/sbir/conferences/
  - Defense Manufacturing Conference
  - Mantech Center of Excellence Conferences
    - SHIPTECH (Navy Metalworking Center)
Connecting
Naval S&T Partnership Conference


• Industry can sign-up to give an Independent Research & Development brief to government:

• CNR Challenge: submit a white paper at the conference to compete for $1 million in research funds:
Nanomaterials for Defense

- Filtration and Biocides
- Composite material reinforcement
- Multifunctional coatings
- Energy and electromechanical systems
- Optical systems
- Nanoelectronics (nanocircuits, sensors)
Filtration and Biocides

- NanoCeram® alumina filter and Seldon filters
  - Air Force sponsored
  - Water purification
  - Bacteria and viruses
  - Arsenic
  - High efficiency
  - High throughput
Composite Material Enhancement

Functionalized carbon nanotubes

- Increased stiffness
- Controlled permittivity for radomes
- Erosion and cavitation resistance for fan blades

Foster-Miller
MER Corp.
NanoLab
NanoRidge Materials
Systran Federal Corp.
Carbon Solutions
Triton Systems
Multifunctional materials, coatings

ONR: SWNT for conductive gap sealants in aircraft

Nanoparticles in glass coatings for anti-fogging, abrasion resistance

AFRL: Nickel nanostrands for conductive resins, paints, adhesives; EMI shielding

NAVSEA: Super hydrophobic surfaces, damage sensing and self-repairing
Energy and Electromechanical

CNT-enhanced Ultracapacitors

ONR: Nanocrystalline cores in power converters

Fig. 5-15 30 kW ferrite core (left) and FT-3M nanocrystalline core (right) transformer prototypes
Body Armor

Nanoparticle and nanotube reinforcement

Images During Impact

<table>
<thead>
<tr>
<th>Images During Impact</th>
<th>Neat Sandwich</th>
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<td>0.47 μs</td>
<td>27.94 μs</td>
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<td>3</td>
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Images During Impact

<table>
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<tr>
<th>Images During Impact</th>
<th>Nanophased Sandwich</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.09 μs</td>
<td>37.30 μs</td>
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<tr>
<td>1</td>
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</table>

| | 22.92 μs | 28.23 μs |
| | 4 | 6 |
Flexible solar cells, printing technology, increased efficiencies with nanoparticles.

Nanotubes on silicon increase surface area.
Nanoelectronics

OSD10-T004
Nanomanufactured catalytic arrays on patterned addressable substrates for advanced electronic device applications

http://www.dodsbir.net/Topics/Default.asp
Deadline: 15 Sept 2010

Goal: uniform growth of high quality multiwalled CNTs perpendicular to substrate
low base contact resistance
Summary

- Wide range of defense applications for nanomaterials
- No “Nano-Central”
- Traditional mechanisms for collaboration
  - SBIR / STTR program managers: Get to know them
  - Mantech
  - Other ONR-sponsored mechanisms
  - Conferences of interest
  - NSRP: Connect with shipbuilders
References

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- http://www.konarka.com/technology/
- http://www.nanosolar.com/
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