



# Global Nanomaterials Opportunity and Emerging Trends

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Lucintel Brief

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Market Intelligence + Growth Consulting + Opportunity Screening + M&A Due Diligence + Benchmarking = **Your Company's Growth.**

[www.lucintel.com](http://www.lucintel.com)

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- ***Nanomaterials Market Outlook***
- ***Market Trends and Opportunities***
- ***Growth Opportunities in 2014 and Beyond***
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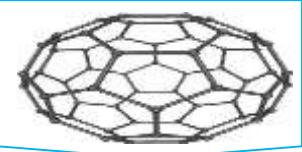
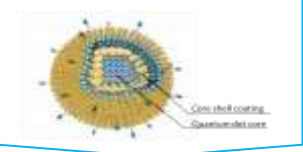

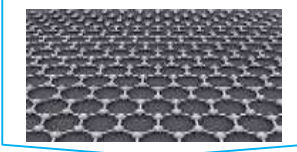
## Executive Summary

- **Global nanomaterials market** was estimated at \$2.5 B in 2013, and is likely to grow at a CAGR of ~16% in the next six years to reach \$6.1 B in 2019
  - Carbon Nano Tubes (CNTs) and nanoclay materials holds major percentage share in the global nanomaterials market, followed by metal nanopowders and quantum dots
  - Graphene market is gaining wider acceptance, and is growing rapidly, driven by better price performance ratio compare to that of other competing materials
  - Major market drivers for healthy growth of the nanomaterials market are new product developments, patent filings, mergers, collaborations and other alliances
- **Major drivers and trends shaping the global nanomaterials market are:**
  - Government funding to encourage nanotechnology
  - Ongoing research & development to identify new and emerging applications and materials
  - Collaborations and joint product development between material suppliers, universities and Government bodies
  - Continuous focus on property improvement and part performance will drive the usage of nanomaterials in future
- **Major suppliers having significant contribution in the development of the nanomaterials market are Clariant, Showa Denko, Arkema, Nanocore, Umicore, and many more**

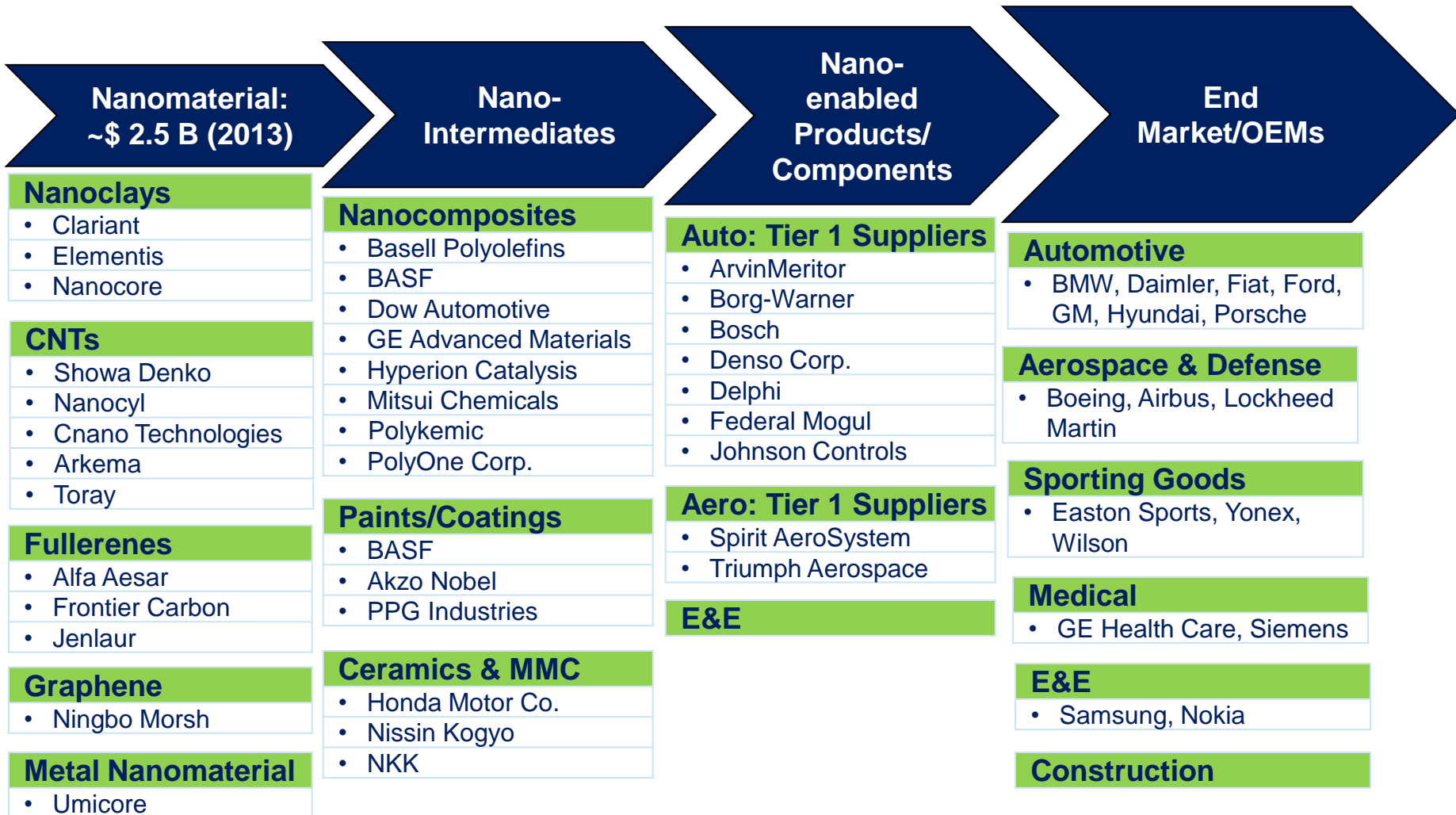
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# Nanomaterials Market Overview

Nanomaterial						
Carbon Nanotubes	Nanoclay	Fullerenes	Quantum Dots	Metal Nanopowders	Graphenes	
						
<ul style="list-style-type: none"> <li>• Excellent mechanical properties</li> <li>• Reduce weight</li> <li>• Radio transparency</li> <li>• Crack/vibration resistant</li> </ul>	<ul style="list-style-type: none"> <li>• Excellent thixotropic agent</li> <li>• Improve gas &amp; liquid barrier properties</li> <li>• Enhance flame retardant</li> </ul>	<ul style="list-style-type: none"> <li>• Reduces weight</li> <li>• Provide flexibility</li> </ul>	<ul style="list-style-type: none"> <li>• High extinction co-efficient</li> </ul>	<ul style="list-style-type: none"> <li>• Good mechanical properties</li> <li>• Improved chemical properties</li> <li>• Resist deformation</li> </ul>	<ul style="list-style-type: none"> <li>• Excellent optical &amp; thermal, electrical and mechanical properties</li> </ul>	
<ul style="list-style-type: none"> <li>• Energy</li> <li>• Sporting Goods</li> <li>• Aerospace</li> <li>• Polymer &amp; Ceramics</li> <li>• Medical</li> </ul>	<ul style="list-style-type: none"> <li>• Automotive</li> <li>• Plastics</li> <li>• Pipe &amp; Tank</li> <li>• Packaging</li> <li>• Paint &amp; Coating</li> <li>• Consumer goods</li> </ul>	<ul style="list-style-type: none"> <li>• Energy</li> <li>• E&amp;E</li> <li>• Automotive</li> <li>• Medical/Health Care</li> <li>• Sporting Goods</li> </ul>	<ul style="list-style-type: none"> <li>• Computing Devices</li> <li>• Medical</li> <li>• E&amp;E</li> <li>• Solar Energy</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial</li> <li>• Healthcare/ Medical</li> <li>• Energy</li> <li>• E&amp;E</li> <li>• Consumer Goods</li> </ul>	<ul style="list-style-type: none"> <li>• Energy</li> <li>• Bio Medical Devices</li> <li>• Energy Storage Devices</li> <li>• E&amp;E</li> </ul>	

## Nanomaterials Value Chain



# Current and Potential Applications of Nanomaterials

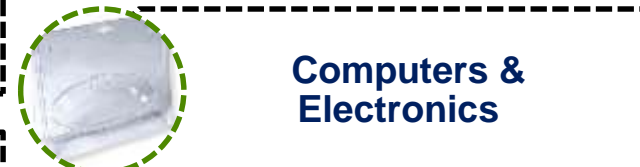
## Transportation



## Construction



## Packaging



# Current and Potential Applications of Nanomaterials

Contd..

## Aerospace & Defense



Aircraft Structures



Wear Resistant  
Paints & Coatings  
for Defense Vehicles

## Consumer Goods



Home appliances



Sporting goods &  
toys



Furniture & others

## Electrical & Electronics



Sensors



Semiconductors



Hard disk storage in  
computers

## Energy



Battery electrodes



Fuel cell membranes



Supercapacitors

## Health Care



Body implants



Medical devices



Dental filling materials

## Others



Anti-foul coatings for  
marine ships



Industrial equipment to  
increase strength



Fire resistant clothes



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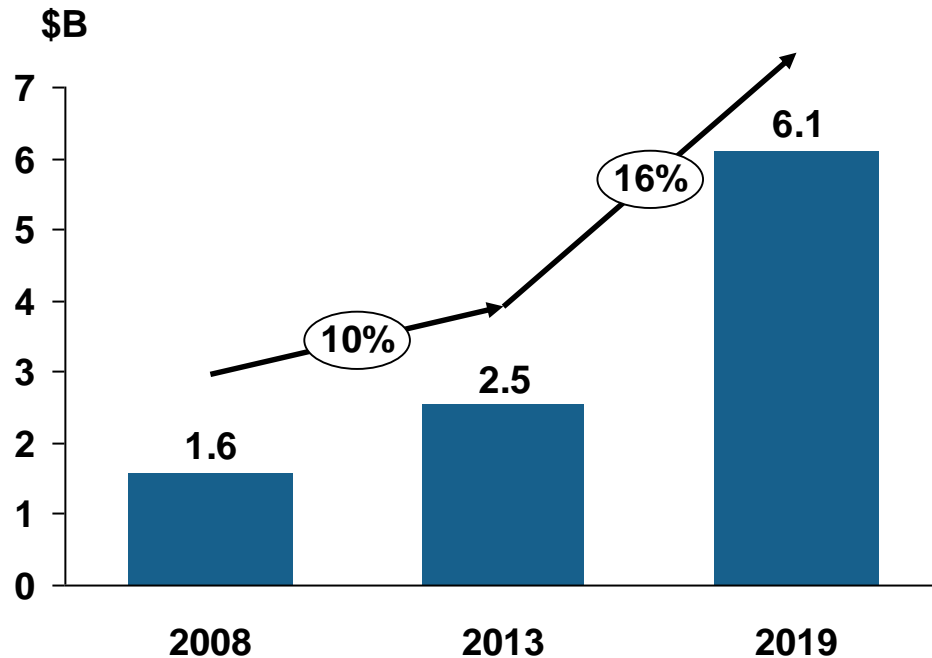
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# External Forces Shaping the Nanomaterials Industry: Future Innovations in this Space will Drive the Growth of Nanomaterials



## Global Nanomaterials Market Trend and Forecast (2008-2019)

**Global Nanomaterials Market Trend and Forecast (\$ B)**  
2008-2019



### Key Insights

- Global nanomaterials market was estimated at \$2.5 B in 2013 and is likely to grow at a CAGR of 16% in next six years to reach \$6.1 B in 2019
  - Carbon Nano Tubes (CNTs) holds major percentage share in Global nanomaterials market and is expected to grow at double digit growth in the next six years
  - Increasing awareness, Government funding, increasing acceptance across industries and ongoing research and development to identify newer applications and new materials are the major drivers shaping nanomaterials market

# Major Drivers, Market Potential and Applications: Global Nanomaterials Market

	Automotive	E&E	Health/ Personal Care	Energy	Others (Sporting Goods, etc.)
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**Nanomaterials Market**



**Major Drivers**

- Light weight
- High strength

- Electrical conductivity

- Diagnostics
- Efficient drug delivery

- Increase efficiency
- Efficient Storage

- Strength to weight ratio
- Crack & vibration resistance

**Major Applications**



Engine & Powertrain



FEDs



Medicines



Wind Energy



Racquets

Archery



Tires



Paint & Coating



Nano electronic Devices



Medical Equipment & Devices



Solar Energy



Golf



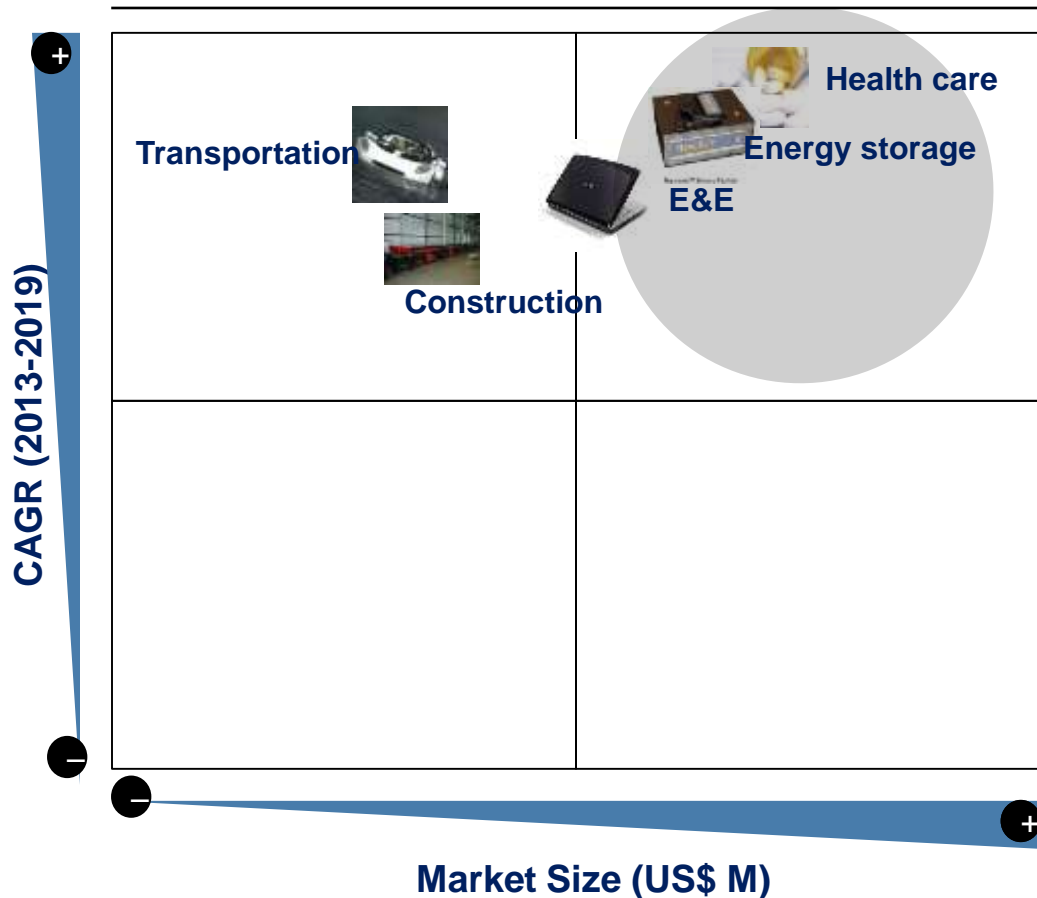
Kayaks

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# Health Care Industry is Expected to Gain Market Share and Overtake E&E Segment in Size Over Next Five Years

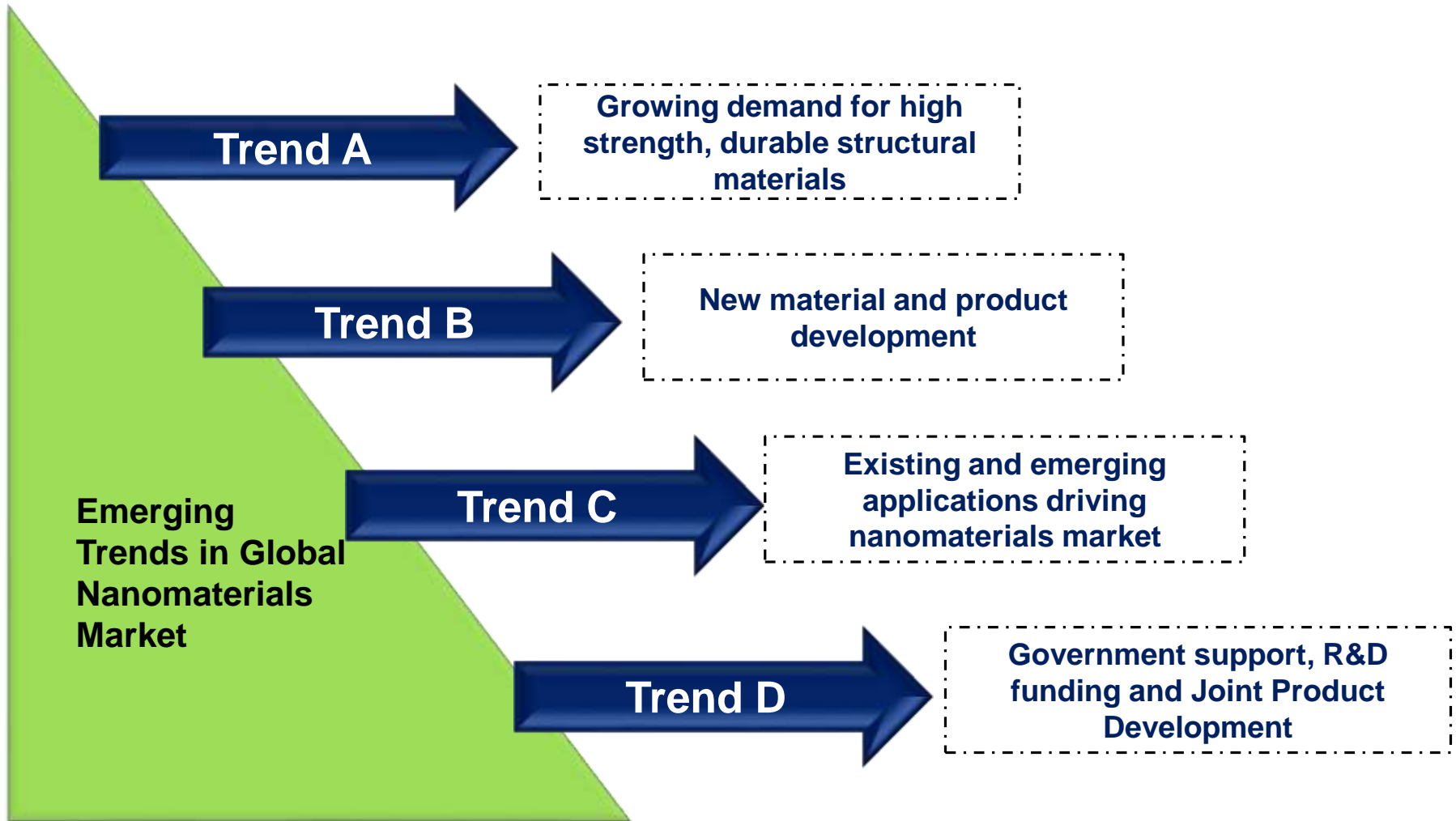
## Growth Opportunities for Nanomaterials in Various Industries



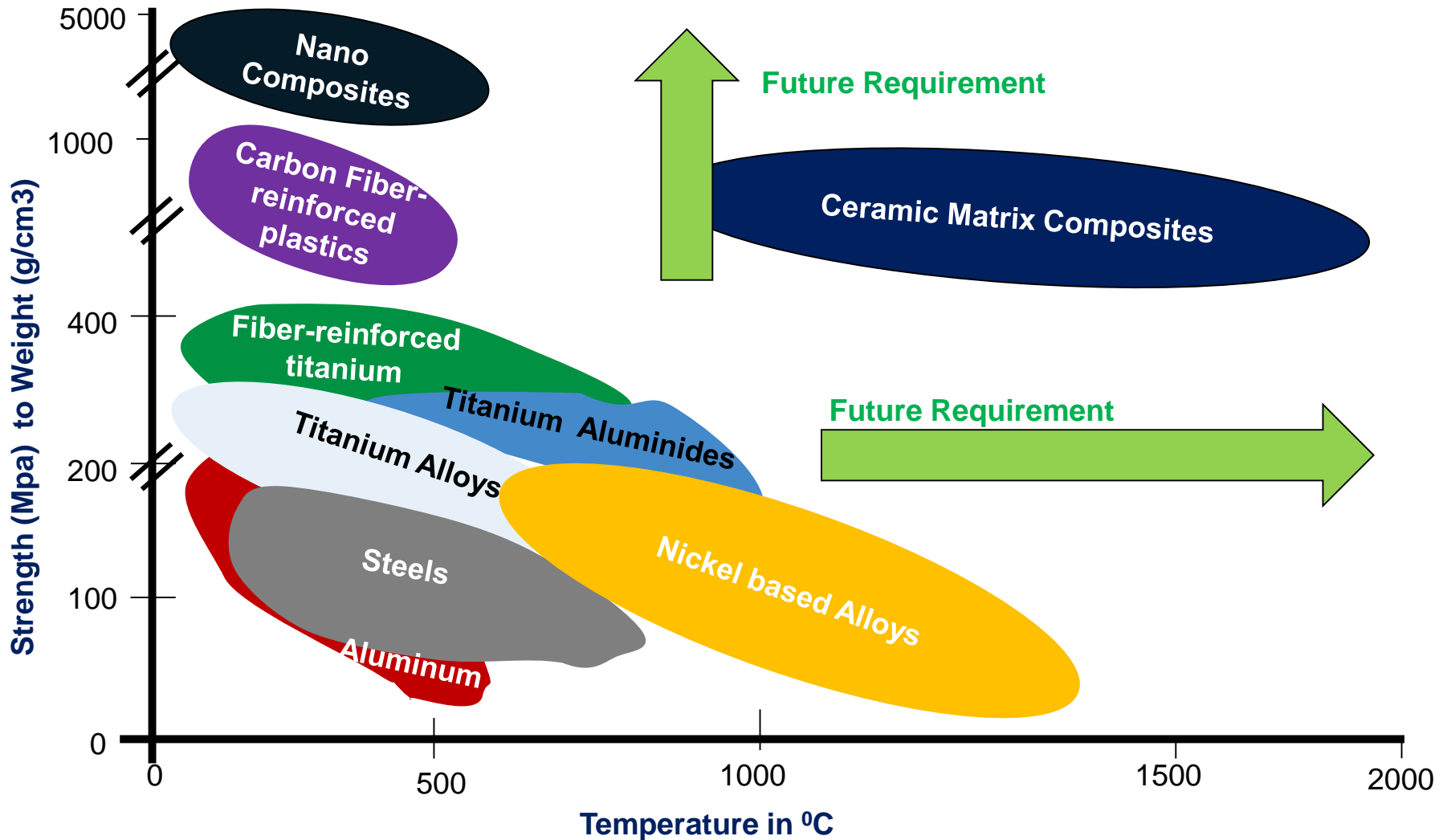
## Key Insights

- Nanomaterials have great potential in electrical and electronics applications because of their extraordinary electrical conductivity
- Packaging is another important segment, flourishing mainly in North America and Western Europe
- Energy segment is also expected to grow at a double digit growth

## Lucintel Predicts Five Key Emerging Trends Shaping the Global Nanomaterials Market



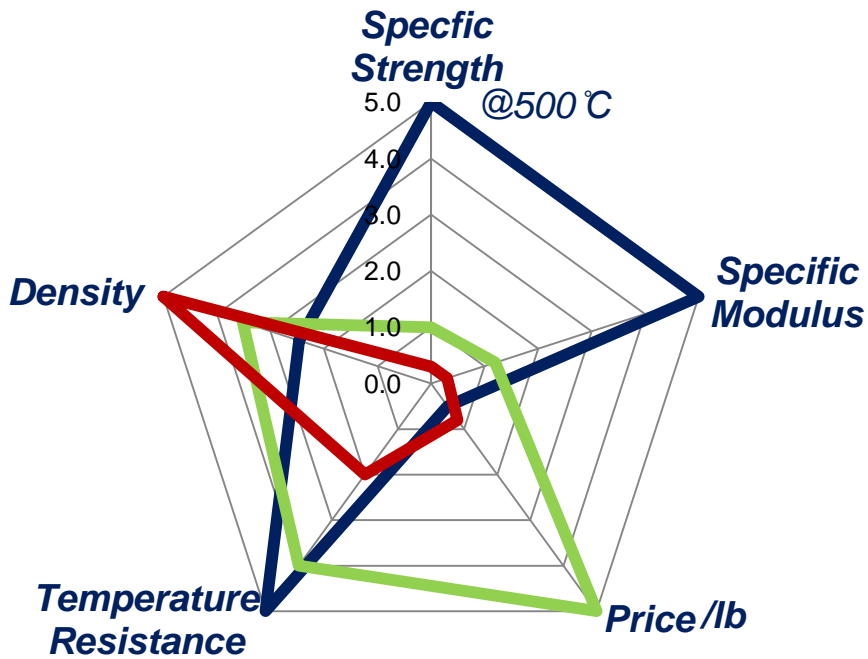
## Trend A: Continuous Focus on Property Improvement and Part Performance Will Drive the Usage of Nanomaterials in Future





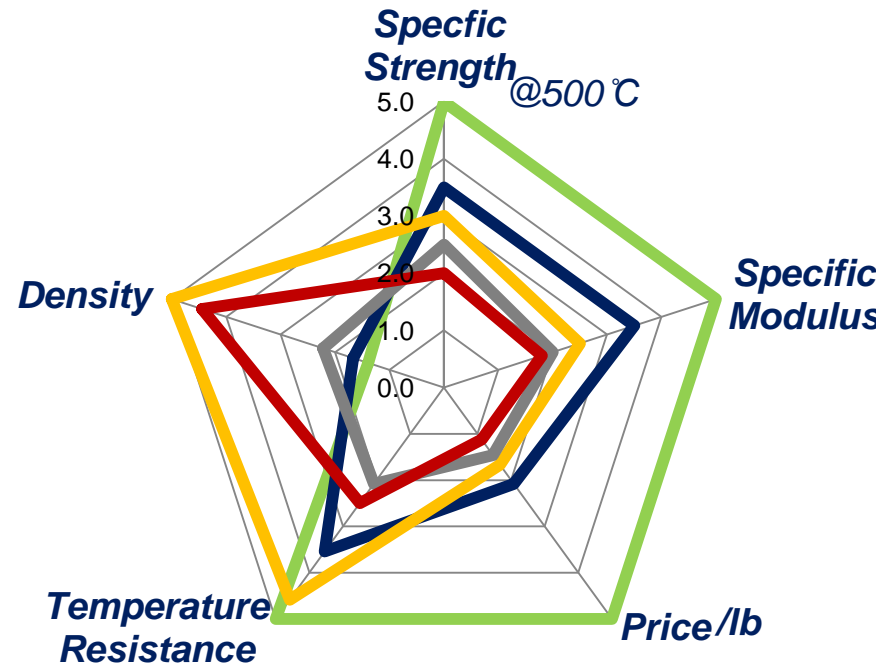
# Continuous Focus on Property Improvement and Part Performance will Drive the Usage of Nanomaterials in Future Contd..

**Airframe**



- Nano Composites
- Carbon Composites
- Aluminum Alloy

**Engine**



- CMC
- TiAl
- Nickel Alloy
- Titanium Alloy
- Steel

# Lockheed Martin Incorporated CNRP into F35 Lightning II Wingtip Fairings Resulting in Significant Cost & Weight Reduction

## Advanced Polymers Engineered for the Extreme (APEX) Technology: A Light-weighting Initiative

### Carbon Nanotube Reinforced Polymer (CNRP) Wing Tip Fairings Benefits over CFRP



Light-weighting

30%

Upto 30% of light weight as compared to CFRP component

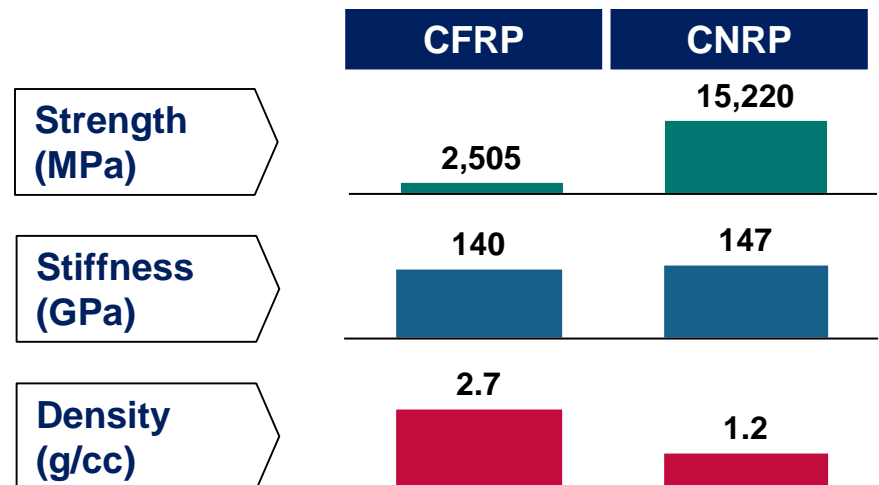
Cost Saving

90%

The new wingtip fairing is being made for one-tenth of the cost of the equivalent CFRP component


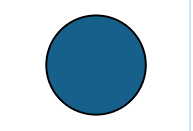

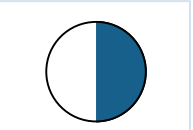

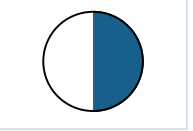


### Typical CNRP Property Comparison with CFRP



Lockheed Martin has identified more than 100 additional parts for potential APEX insertion into the F-35 to achieve additional cost savings









# Trend B(i): Increasing Adoption of Nanomaterials to Improve Mechanical & Chemical Properties of End Parts at Reduced Weight and Prices

Application	Nanomaterial Used	Unmet Needs	Industry Served	Benefits Derived	Relative Importance
 <b>LED Lights</b>	<ul style="list-style-type: none"> <li>Nano Ceramic Aluminum</li> </ul>	<ul style="list-style-type: none"> <li>Low cost LED devices</li> <li>Temperature performance</li> </ul>	<ul style="list-style-type: none"> <li>Automotive &amp; Mass Transportation</li> <li>Construction &amp; Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>25% cost reduction of LED devices</li> <li>43% Component count reduction</li> <li>24% assembly cost reduction</li> </ul>	
<b>Application Developer: Cambridge Nanotherm</b>					
 <b>Batteries</b>	<ul style="list-style-type: none"> <li>Carbon Nanotubes</li> <li>Carbon Nanowires</li> </ul>	<ul style="list-style-type: none"> <li>Environmental friendly</li> <li>Smaller in size</li> <li>Low cost</li> </ul>	<ul style="list-style-type: none"> <li>Transportation</li> <li>Energy</li> <li>Healthcare</li> <li>Defense</li> <li>Electronics</li> </ul>	<ul style="list-style-type: none"> <li>Reduction in toxicity of electrolyte solution</li> <li>Significant reduction in size of the batteries</li> <li>Prevents loss of active materials during storage</li> </ul>	
<b>Application Developer: mPhase Technologies</b>					
 <b>Blade Paint</b>	<p><b>Not Available</b></p>	<ul style="list-style-type: none"> <li>Anti-Icing solution with improved resistance to corrosion</li> </ul>	<ul style="list-style-type: none"> <li>Wind Energy</li> </ul>	<ul style="list-style-type: none"> <li>Prevents ice formation</li> <li>Improves efficiency</li> <li>Sustain &amp; improves corrosion resistance property of a blade</li> </ul>	
<b>Application Developer: Gamesa</b>					

**Importance to Industry** ● High ○ Low

## Trend B(ii): Product Launches in Nanomaterial

Contd..

Innovation Description	Material Name	Company Launched	Market Served	Innovation Attractiveness		
				Ease of Integration	Application Enhancement	Market Acceptance
<b>Attractive product launches in intermediates</b>						
Hybrid glass/carbon fiber nanofabric	Not Available	Carbon Composite Technologies	Wind-Energy, Aerospace, Armor, Marine and Automotive			
Nano Adaptive Hybrid Fabric	Fuzzy Fiber	URDI, Goodrich, Owens Corning, Renegade Materials	Wind-Energy			<b>NA</b>
Nanocomposite Prepreg	Arovex HT	Zyvex	Sporting Goods			

**Degree of Attractiveness**



**High**



**Low**

## Trend C: Applications driving Opportunities in the Automotive, Medical and Energy Industries

### Key Insights

- Nanocomposites exhibits excellent mechanical properties, dimensional stability, impact and scratch resistance, better thermal properties, etc.
- Energy industry can also be benefitted with the nanotechnology ensuring better efficiency in energy production and storage
- Major driver in increasing usage of nanocomposites in automotive applications are reduction in vehicle weight and improved engine efficiency (ensuring better mileage and emission reduction)



**Engine and Powertrain**



**Wind Energy**



**Solar Energy**



**Suspension & Braking System**



**LED Lights**



**Medicines**



**Lubricant**



**Medical Equipment & Devices**



**Engine Cover**

## Trend D (i): Government Support and R&D Funding to Universities, Technology Centers and Material Suppliers



**UDRI**

- A \$3 million Ohio Third Frontier award to the University of Dayton Research Institute will help in ramping up the production of a new carbon nanomaterial



**MIT**

- The Massachusetts Institute of Technology researchers have produced carbon fibers coated with carbon nanotubes that sustains the mechanical properties of the base fibers



**Georgia  
Tech**

- The U.S. Department of Energy (DOE) Grant to Georgia Institute of Technology to develop an additive manufacturing technique for fabricating three-dimensional (3D) nanoscale structures from a variety of materials

## Trend D(ii): Collaborations and Joint Product Development between Materials Suppliers, Universities and Government Bodies

Contd...



- The investment agreement worth \$4.3 Million between DowAksa & Nanotechnology Center of Composites to develop nanocomposites solution benefiting customers

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## Three Growth and Profit Scenarios in Nanomaterials Market

### Scenario 1: Expand Core Business

*Identify unmet needs in existing applications*

*Strategic alliances across value chain nodes*

### Scenario 2: Growth Segments and Application Development

*Target growing segments such as automotive, medical*

*Focus on growing Graphene market*

*Develop cost effective solutions for composites*

### Scenario 3: Emerging Region

*Growing paint and Coatings, composites, and E&E market in Asia will drive the higher consumption of nanomaterials*

**Profit**

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## About Lucintel

### **Vision:**

- Passion for data, insights, strategy and innovation. Empower companies to take better decisions

### **History**

- Founded in 1998
- Over 120 analysts / consultants. Global presence

### **Industry Leadership**

- Over 1000 clients from 70 countries – Fortune 500 companies
- Fifteen years of proven management consulting and market research experience
- Panelists and key note speakers at leading conferences

### **Services:**

- Market entry strategy, M & A services, strategic consulting, due diligence, growth finance, competitive assessment, and opportunity screening