Morphology Matters:

Branched Carbon Nanotubes for Advanced Polymers

VIADUCT
Innovative Technologies

Mechanical reinforcement and electrical functionality at ultra-low loading

THE POLYMER ADDITIVE PROBLEM...

CAN ONE LOW-LOADING ADDITIVE IMPROVE MULTIPLE PROPERTIES AT ONCE?

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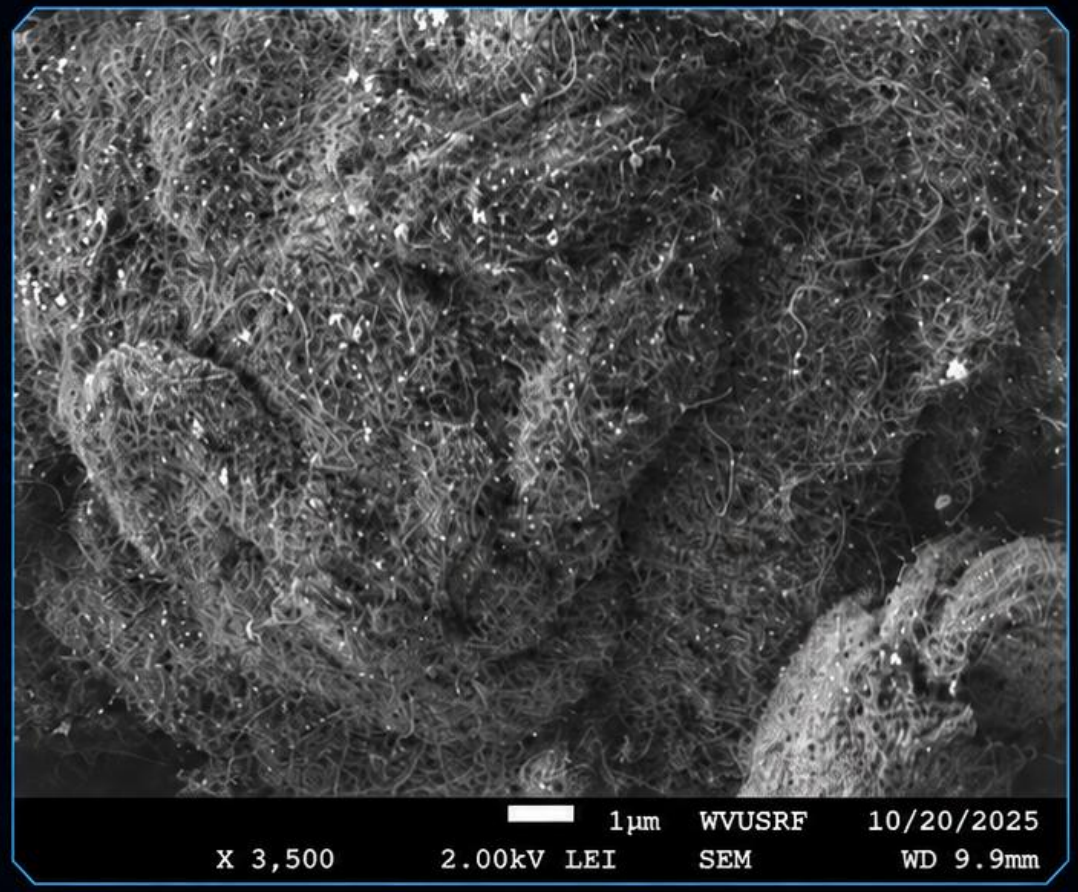
VIADUCT'S ANSWER IS BRANCHED MORPHOLOGY

- MORE CONTACT POINTS
- MORE REINFORCEMENT SITES
- MORE CRACK-BRIDGING OPPORTUNITIES
- MORE ELECTRICAL PATHWAY FORMATION
- LOWER REQUIRED LOADING



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VIADUCT INNOVATIVE TECHNOLOGIES

Jay Hewitt leads **Viaduct Innovative Technologies**, a Morgantown, West Virginia–based advanced materials company commercializing high-purity branched multiwalled carbon nanotubes for industrial polymers, coatings, composites, additive manufacturing, and electrically functional systems.

With support from West Virginia University's Chemical Engineering Department, **Viaduct** is focused on moving advanced carbon materials from technical validation into commercial applications.

98.5% PURITY

<15% ASH CONTENT

1 KG PACK SIZE

VIADUCT Innovative Technologies

SUPPORTED BY

West Virginia University
Chemical Engineering Department

FOCUSED ON

- INDUSTRIAL POLYMERS
- COATINGS
- COMPOSITES
- ADDITIVE MANUFACTURING
- ELECTRICALLY FUNCTIONAL SYSTEMS

WHY BRANCHED MORPHOLOGY MATTERS...

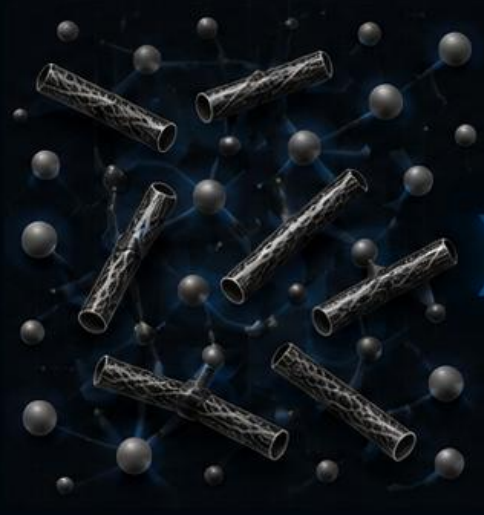
STRAIGHT OR POORLY DISPERSED FILLERS
can behave like isolated particles

A BRANCHED MORPHOLOGY
creates more tube-to-tube contact points

MORE CONTACT POINTS
improve stress transfer and electrical pathway formation

THE MORPHOLOGY
may reduce the amount of additive needed to create useful performance

STRAIGHT / POORLY DISPERSED FILLERS



ISOLATED PARTICLES
Limited contact
Poor network formation

BRANCHED MORPHOLOGY (MORE CONTACT POINTS)

CONNECTED NETWORK
More contact points
Stronger pathways

IMPROVED STRESS TRANSFER
Better mechanical reinforcement

ENHANCED ELECTRICAL PATHWAYS
More efficient conductive networks

LOWER LOADING REQUIREMENTS
Achieve performance with less additive

...IT HELPS CONVERT NANOSCALE PROPERTIES INTO MACROSCALE PERFORMANCE.

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BMWCNT NETWORK IN POLYMER

MECHANICAL REINFORCEMENT

- Distributes stress through the resin
- Improves load transfer
- Reduces localized failure

TOUGHNESS AND ELONGATION

- Interrupts crack growth
- Bridges microcracks
- Helps absorb energy before failure

ELECTRICAL FUNCTION

- Creates conductive pathways
- Moves material toward ESD or conductive ranges
- Reduce filler loading

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NYLON 6

- USED IN INDUSTRIAL AND ENGINEERED PARTS
- GOOD BASELINE MECHANICAL PERFORMANCE
- RELEVANT TO AUTOMOTIVE, ELECTRICAL, INDUSTRIAL, AND ADDITIVE MANUFACTURING MARKETS
- DIFFICULT ENOUGH TO BE MEANINGFUL, COMMON ENOUGH TO MATTER

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AMPACET NYLON 6 CASE STUDY

MATERIAL SYSTEM: Nylon 6 2mm

ADDITIVE: Viaduct high-purity branched BMWCNTs

PROCESSOR: Ampacet

FORM: Masterbatch and let-down formulations at 5% loading

LOADINGS TESTED: .5%, .25%, .1% and .05%

PROCESSING: Twin Screw w/side feeder

TESTING: tensile strength, elongation, processing behavior baseline mechanical performance

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AMPACET
Plastics Reimagined™

MORPHOLOGY MATTERS WHEN IT TRANSLATES INTO PERFORMANCE

AT .05% LOADING

EXCELLENT DISPERSION
Uniform distribution of BMWCNTs throughout the nylon 6 matrix

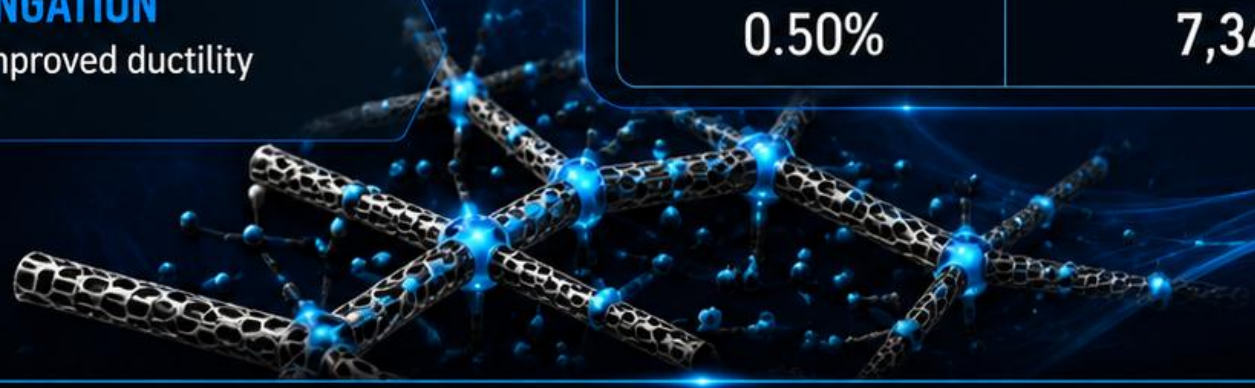
LOCAL PRODUCTION
Enabled by Viaduct's branched BMWCNT morphology

215% TENSILE STRENGTH
Significant improvement over unfilled nylon 6

1,150% ELONGATION
Dramatically improved ductility and toughness

MECHANICAL PERFORMANCE OF NYLON 6 WITH VIADUCT BRANCHED BMWCNTS

Loading	Tensile (psi)	Elongation (%)
Base (0%)	2,679	38.39
0.05%	8,383	492.16
0.10%	7,878	467.15
0.25%	7,360	449.64
0.50%	7,347	455.11



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AMPACET Plastics Reimagined™

AMPACET NYLON 6 CASE STUDY

LOW-LOADING ECONOMICS

Final CNT Loading	5% Masterbatch Letdown Rate	CNT Cost Added Per lb of Finished Compound
0.05%	1%	$0.14/lb
0.10%	2%	$0.28/lb
0.25%	5%	$0.69/lb
0.50%	10%	$1.38/lb

Using a conservative pricing case, BMWCNTs add approximately **$0.14** per pound of finished compound, with volume pricing further reducing that cost.

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CALL TO ACTION: WE ARE LOOKING FOR CUSTOMERS

BEST-FIT CUSTOMER APPLICATIONS:

ESD AND CONDUCTIVE COMPOUNDS
Static control and conductive performance

REINFORCED ENGINEERING PLASTICS
Enhanced strength and durability

INJECTION-MOLDED INDUSTRIAL COMPONENTS
High performance for demanding environments

AUTOMOTIVE, AEROSPACE, DEFENSE, AND ELECTRICAL PARTS 3D PRINTING FILAMENT AND PRINTED COMPONENTS
Reliable performance in critical applications

FUNCTIONAL COATINGS AND RESIN SYSTEMS
Improved properties and system performance

WHAT WE NEED FROM CUSTOMERS:

A TARGET POLYMER SYSTEM
The material family or system of interest

A PERFORMANCE PROBLEM WORTH SOLVING
The challenge you're facing today

A TARGET SPECIFICATION
Key requirements and performance goals

A PATH TO QUALIFICATION
How the material will be tested and validated

A PATH TO PURCHASE IF THE MATERIAL MEETS REQUIREMENTS
Volume, timing, and commercial pathway

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Innovative Technologies

LET'S INNOVATE TOGETHER.
Delivering advanced materials for a better future.

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Morphology Matters When It Translates Into Performance

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