CABOT

CONDUCTIVE CARBONS

PRODUCT GUIDE

ATHLOS™ CARBON NANOSTRUCTURES

Advanced Conductive Carbon Solutions for High Performance Applications.

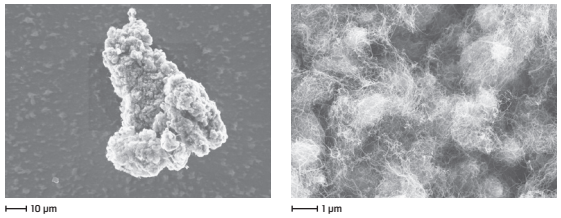
Why ATHLOS™ Carbon Nanostructures?

Cabot's ATHLOS™ carbon nanostructures (CNS) deliver a unique blend of ultra-high conductivity, high performance shielding capabilities and mechanical strength. CNS can help your products meet the most stringent conductivity requirements at a fraction of the loading of traditional additives, optimizing performance while driving reductions in cost and weight. With a unique morphology of cross linked and branched carbon nanotubes, CNS offer enhanced conductive pathways enabling significant performance advantages vs. conventional carbon nanotubes (CNT). Their morphology enables a reduction in dust contamination in processing and improves industrial hygiene compared to other conductive carbon additives.

What are ATHLOS™ Carbon Nanostructures?

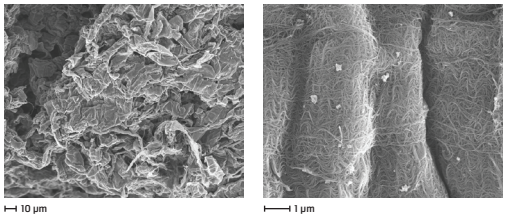
ATHLOS™ carbon nanostructures are a unique network of crosslinked carbon nanotubes and are produced using a proprietary roll-to-roll chemical vapor deposition (CVD) process. This process enables CNS to have a greater carbon content than traditional CNT.

Carbon Nanotubes (CNT)



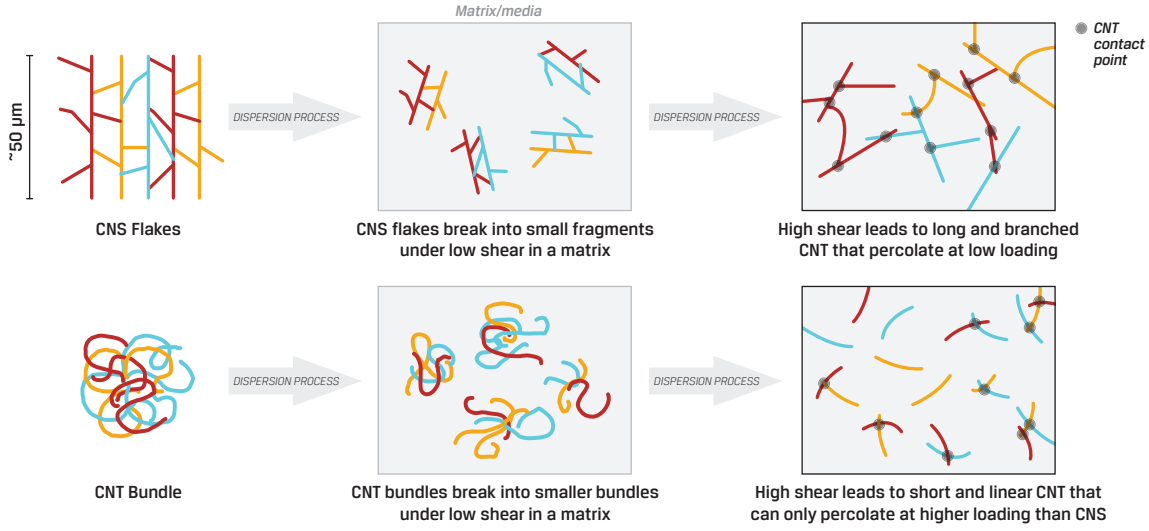
CNT feature a bundled morphology that can be difficult to disperse effectively.

ATHLOS™ CNS



CNS' forest of crosslinked branched nanotubes disperse more easily than CNT.

Dispersion Comparison



CNS Flakes

CNS flakes break into small fragments under low shear in a matrix

High shear leads to long and branched CNT that percolate at low loading

CNT Bundle

CNT bundles break into smaller bundles under low shear in a matrix

High shear leads to short and linear CNT that can only percolate at higher loading than CNS

Conductivity Performance

ATHLOS™ Carbon Nanostructures offer unparalleled levels of conductivity at very low loadings, outperforming conductive specialty carbon blacks, multi-walled CNT and even single-walled CNT in independent tests. Figures 1-4 show the correlation of resistivity to loading, offering a good comparison of the relative conductivity performance of different conductive carbon additives in polymer compounds. Enabling highly conductive performance at relatively low loadings results in reduced mechanical impact on the final product.

Fig 1: **Volume Resistivity**

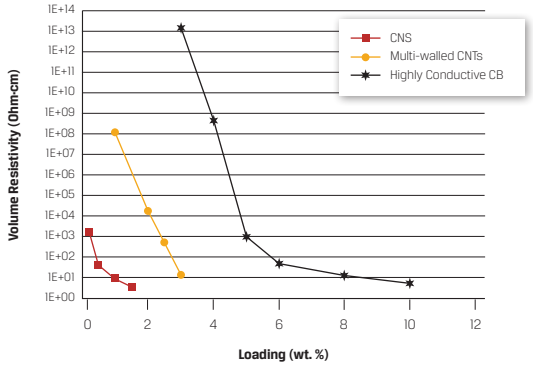
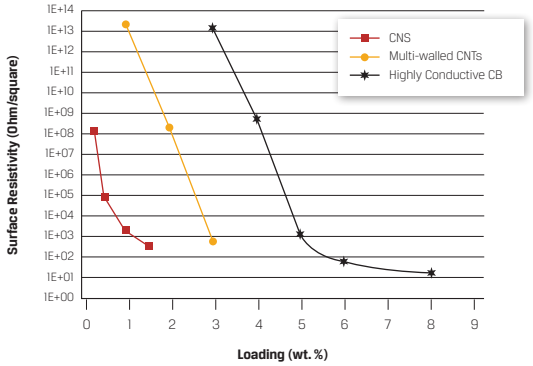


Fig 2: **Surface Resistivity**



Volume and surface resistivity tests were performed according to Cabot internal test method on injection molded polycarbonate compounds produced in a twin-screw extruder.

Fig 3: **Volume Resistivity in Polycarbonate**

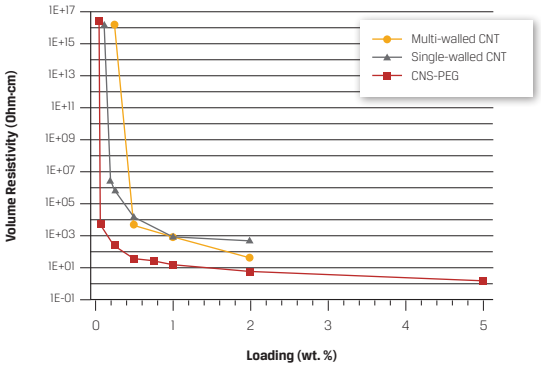
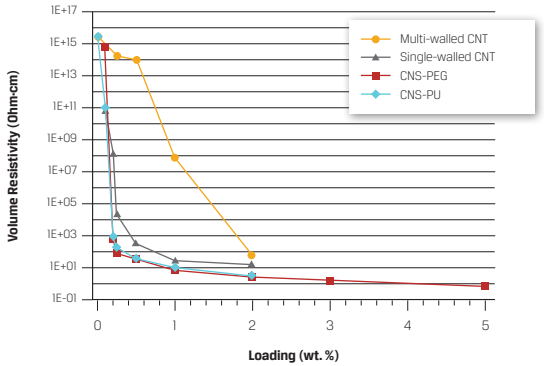


Fig 4: **Volume Resistivity in Polyvinylidene Fluoride**



Data in figures 3 and 4 obtained from "Comparative study of singlewalled, multiwalled, and branched carbon nanotubes melt mixed in different thermoplastic matrices," by Krause, B., Barbier, C., Kunz, K. and Pötschke, P. as presented in 2018. *Polymer*, 159, pp.75-85.

Mechanical Performance

ATHLOS™ CNS are not only differentiated in conductivity performance, they also enable improved mechanical properties in a simpler formulation, achieving equivalent resistivity vs. alternative conductive carbon materials and significantly better processability vs. multi-walled CNT.

Fig 5: **Flexural Modulus**

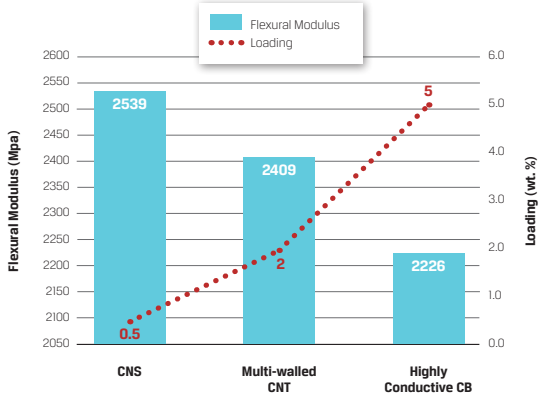
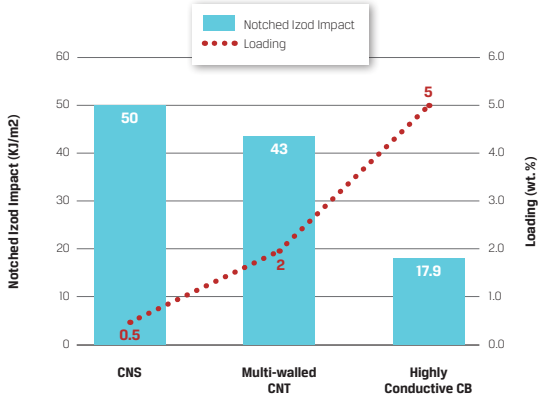


Fig 6: **Notched Izod Impact**



Processing Advantages

ATHLOS™ CNS offer significantly improved processing vs. multi-walled CNT.

	CNS	Multi-walled CNT	Conductive CB
Processability	◕	◔	●
Dispersibility	◕	◔	●
Handling	●	◔	◑

● Excellent
◕ Good
◑ Satisfactory
◔ Poor

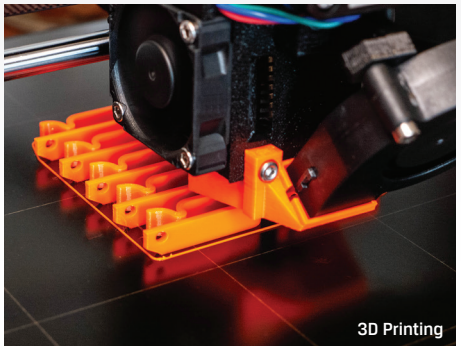
Optimal Performance and Value

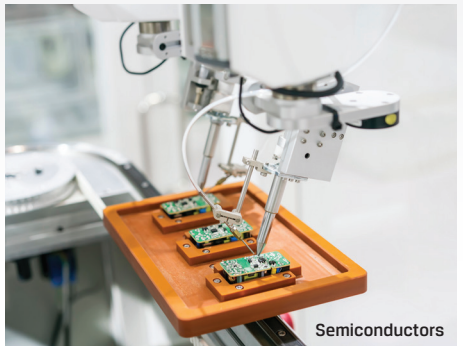
ATHLOS™ CNS' enable an optimal balance of conductivity, EMI shielding, mechanical strength, and processability which makes them an excellent choice for applications requiring premium performance. CNS' low loading requirements to achieve optimal performance allows for a comparatively low cost-in-use vs. alternative carbon additives.


EMI Electronics Shielding


Aerospace and Defense


Healthcare


3D Printing


Semiconductors

CABOT

cabotcorp.com

Technical Support
North America: +1 800 462 2313
CNS@cabotcorp.com