SOLVING GLOBAL PROBLEMS
WITH ADVANCED MATERIALS

1.35 MILLION road traffic deaths per year due to driver error

AgeNT™

PRINTED ELECTRONICS

SAFER CONNECTED DRIVING

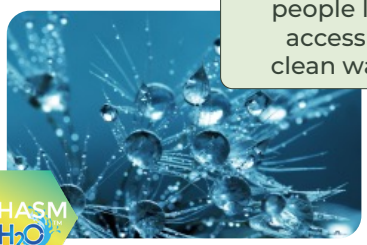
8% of CO_2 emissions globally are from cement

NTeC™

ADVANCED CARBONS

GREENER SMARTER CONCRETE

785 MILLION people lack access to clean water



CHASM H_2O™

ADVANCED MEMBRANES

ABUNDANT PURE WATER

CHASM is pioneering the use of Carbon Nanotubes (CNTs) to develop a new class of advanced materials for safer, connected and more sustainable living. Better connected smart cities, ice-free vehicle sensors and lights, better EV batteries, greener (lower carbon footprint) concrete, and abundance of pure water are all innovations powered by CHASM Advanced Materials. We do this by unleashing the power of CNTs with our patented nanotube manufacturing platform combined with our unique ability to integrate CNTs into game-changing “nanotube hybrid” product solutions.

Printed Electronics materials are made with precision-grown CNTs formulated into nanotube inks that can be printed using industrial methods. Nanotube hybrid transparent conductive films (TCFs) with superior performance and affordable cost are created by printing nanotube inks on top of specialty films coated with other TCF materials. CHASM’s products include inks, films and printed circuits.

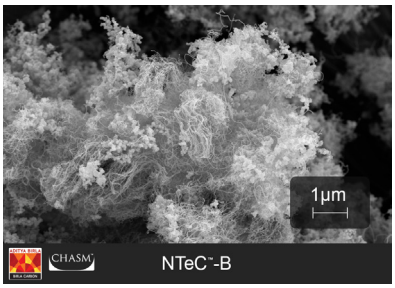
Advanced Carbon materials are made by growing CNTs “in situ” with other particles such as carbon black or cementitious materials to create nanotube hybrid particles that deliver the performance punch of nanotubes without the dispersion challenges typically associated with nanotubes. CHASM’s nanotube manufacturing platform is the most scalable, cost-efficient and sustainable method for mass production of nanotube materials. CHASM’s products include nanotubes or nanotube hybrids in the form of powders or pre-dispersed materials.

Advanced Membranes are made with precision-grown CNTs formulated into nanotube inks that are roll-to-roll coated to create vertically aligned nanotubes locked inside an impervious polymer matrix. CHASM’s reverse osmosis (RO) membrane products are being developed to provide unmatched selectivity (highest purity) with far superior water flow to finally make affordable and pure water abundant for people, agriculture and industry.

In collaboration with leading industrial partners, academic institutions and government agencies, CHASM is accelerating the commercialization of Advanced Materials to create a safer, more connected, and sustainable future.

NTeC™

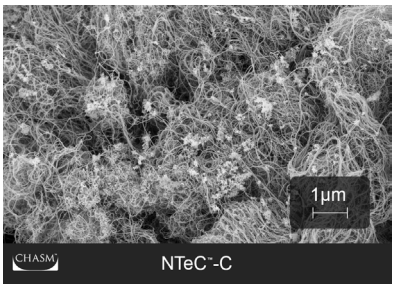
NANOTUBE HYBRID PARTICLES



NTeC-B = CNT + Carbon Black

NTeC™-B

NTeC™-B is a nanotube hybrid created by growing CNTs in situ with carbon black particles, delivering the performance punch of nanotubes, while processing like carbon black. CHASM has a strategic partnership with Birla Carbon, the world's leading producer of carbon black. NTeC™-B conductive additives enable lithium-ion batteries with high energy density and high power density for high-performance EVs. NTeC™-B reinforcing additives are expected to enable much improved cut and chip/tear resistance for high-performance tires.



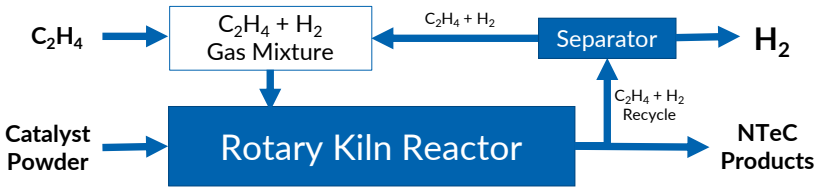
NTeC-C = CNT + Silica

NTeC™-C

NTeC™-C is a nanotube hybrid created by growing CNTs in situ with cementitious particles. Tiny loadings of NTeC™-C cement additives dramatically improves strength and stiffness of cement. This enables higher loadings of supplemental cementitious materials for decarbonization of concrete. NTeC™-C cement additives also naturally form self-sensing networks for early crack detection in concrete structures. The nanotube hybrid structure also makes it possible for nanotubes to be dispersed in water using scalable industrial methods.

NANOTUBE MANUFACTURING PROCESS

CHASM's proprietary nanotube manufacturing platform is believed to be the most scalable, affordable and sustainable method known for mass production of CNTs. This platform uses a rotary kiln reactor, which can be scaled with high capital efficiency. Production is low-cost and sustainable due to economies of scale and efficient use of materials, including recycling of hydrocarbon feed gas and using hydrogen byproducts as fuel to heat the reactor.



✓ SELF DISPERSING

✓ SCALABLE

✓ SUSTAINABLE

CHASM™

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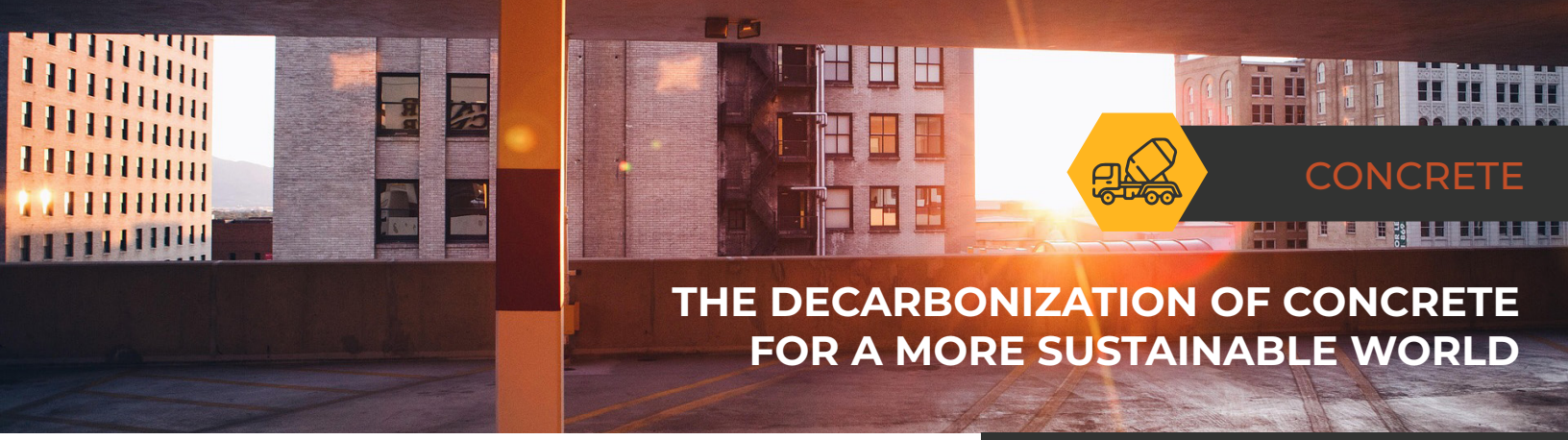


CONCRETE

THE DECARBONIZATION OF CONCRETE FOR A MORE SUSTAINABLE WORLD

DECARBONIZATION OPPORTUNITY

Cement, the main binder in concrete, contributes to nearly all of concrete's carbon footprint. The process of manufacturing cement emits more than 680 kgs CO_2 for every metric ton produced and overall contributes to over 8% of all manmade emissions. Reducing the amount of cement in concrete is challenging because it compromises its overall strength and integrity. NTeC™-C is here to change that. It is known that adding even 0.1% of Carbon nanotubes (CNT) by wt. of cement modifies concrete and provides substantial boost to the overall mechanical properties.

This superior performance creates the opportunity for high volume (over 50%) replacement of cement with other Supplementary Cementitious Materials (SCM) like fly ash and slag - creating the potential to reduce the carbon footprint of concrete by more than 50%. While there are major barriers to achieving this goal, CHASM's pioneering invention of CNT Hybrids (NTeC™-C) overcomes all major barriers of COST, DISPERSABILITY and SCALE, enabling the construction industry to adopt this new additive to accelerate its decarbonization.

ENABLING GREENER SMART CONCRETE

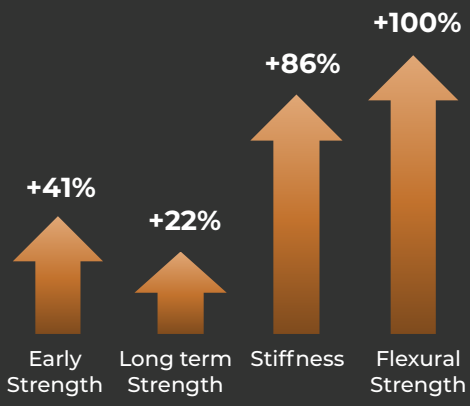
GREEN: Demonstrating GHG reduction by reducing cement content in concrete by adding 0.1% of CNTs creates the opportunity to reduce over 30 million MT of CO_2 emissions in the U.S alone. A projected case study of a typical 15 Million sq. ft. semiconductor fab: The factory floor alone will call for ~15 mill cu ft of concrete which when enabled by only 115 MT of NTeC-C can reduce over 59,500 MT of CO_2 emissions which is equivalent of removing over 13,000 passenger vehicles/year.

ALTERNATE GREEN CHEMISTRIES: NTeC™-C can further be leveraged to substantially enhance the properties of alternate green chemistries for cement like LC3 by compensating its drawbacks like "early strength" and enable faster adoption.

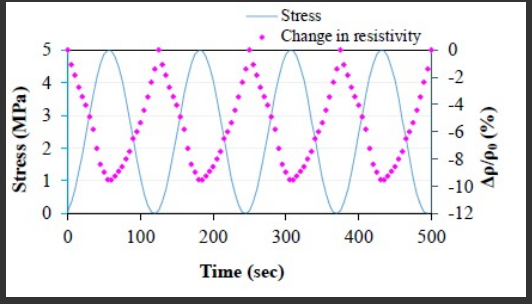
SMART: CNT additives make concrete smart in its "self-sensing" ability of stresses and overall structural integrity. This lays the foundation for an "internet of concrete" approach for proactive life cycle management of critical structures. This in-situ monitoring ability can further enhance the confidence in alternate green technologies and thereby accelerate the cement & concrete industries zero-carbon journey.

UNIVERSITY OF TEXAS ARLINGTON

The University of Texas Arlington Center for Advanced Construction Materials (CACM) testing shows that dramatic improvements in mechanical properties are realized for mortars made with NTeC™-C cement additives (at only 0.1 to 0.15% CNT loading). This is a clear indicator that these additives can be used in combination with supplemental cementitious materials (SCMs) to offset any trade-offs in mechanical properties that commonly result from replacing too much of the Portland cement with SCMs. The more SCMs that can be used, the greater the decarbonization of concrete.



CACM testing shows that the piezoresistive response of mortars made with NTeC™-C cement additives (at only 0.1 to 0.15% CNT loading) is a clear indicator that these additives can be used to enable "smart" concrete, which allows for continuous monitoring of the health of concrete structures.



Let’s Create Something Together

Together, we can turn your innovative concepts into reality. Are you ready to introduce your ideas to the world?

CHASM™

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