Carbon Nanomaterial Enabled Ultra Conductive Metal Composites (UCC)

Tolga Aytug, PhD
Physical Sciences Directorate

Dr. Tolga Aytug is a senior research staff member in the Chemical Sciences Division at ORNL. He received his PhD in physics from the University of Kansas. He is an expert in processing of advanced materials, using both physical and chemical vapor deposition, and chemical solution approaches, as well as advanced materials characterization and microstructure-property correlations for process optimization. He has published over 100 articles in referred journals and has written two book chapters. He holds 13 issued US patents.

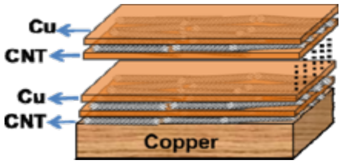
Intellectual Property

Carbon Nanomaterial Enabled Novel Ultra Conductive Copper Composites; ID-3766

Carbon Nanomaterial Copper Composites; ID-3946

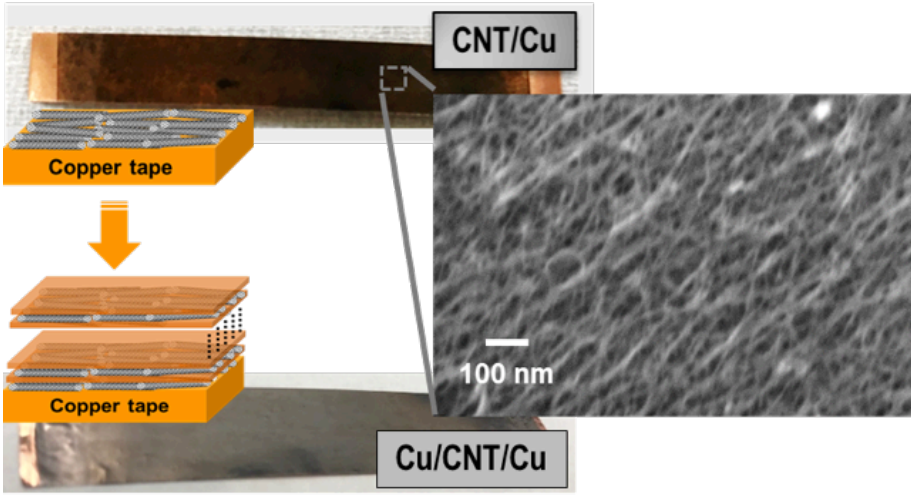
Problem: A growing demand for electrical energy and the increasing need for high-power grid systems necessitate development of new conductors that provide enhanced electrical and thermal conductivity. In preliminary work, ORNL has produced UCCs with conductivities 4-5% greater than that of pure copper. Conductivities are expected to continue to increase as the process matures. A new class of high-performance Cu (Al) conductors—ultra-conductive metal composites (UCC)—is needed to provide enhanced electrical and thermal conductivity.

Solution: Carbon nanomaterial enabled UCC metal composites combine ORNL's strength in nanomaterial research, electron microscopy, and scalable material processing together with novel methods to produce a scalable assembly of Cu-CNT multilayer composites. These composites enable higher electrical conductivities than that of pure Cu.



Using scalable, cost-effective, and commercially viable solution-based processing methods, our technological platform achieves a high degree of CNT alignment and coating stability, which demonstrates a novel technological platform to reproducibly produce carbon nanomaterial enabled ultra conductive conductors for a broad range of electrical systems and industrial applications.

Impact: Commercialization of this technology will potentially result in immense technological and economic value across diverse energy sectors (e.g., electronic devices, electric machines/motors, grid applications) and will help to reduce greenhouse gas emissions while supporting the global competitiveness of clean energy products. The market potential of this technology is staggering. For instance, the projected global market for wire and cable, which is currently valued at $205 billion, is expected to reach $297.4 billion by 2019.



For more information, please contact
Jennifer Caldwell
Commercialization Manager
caldwelljt@ornl.gov
865-574-4180